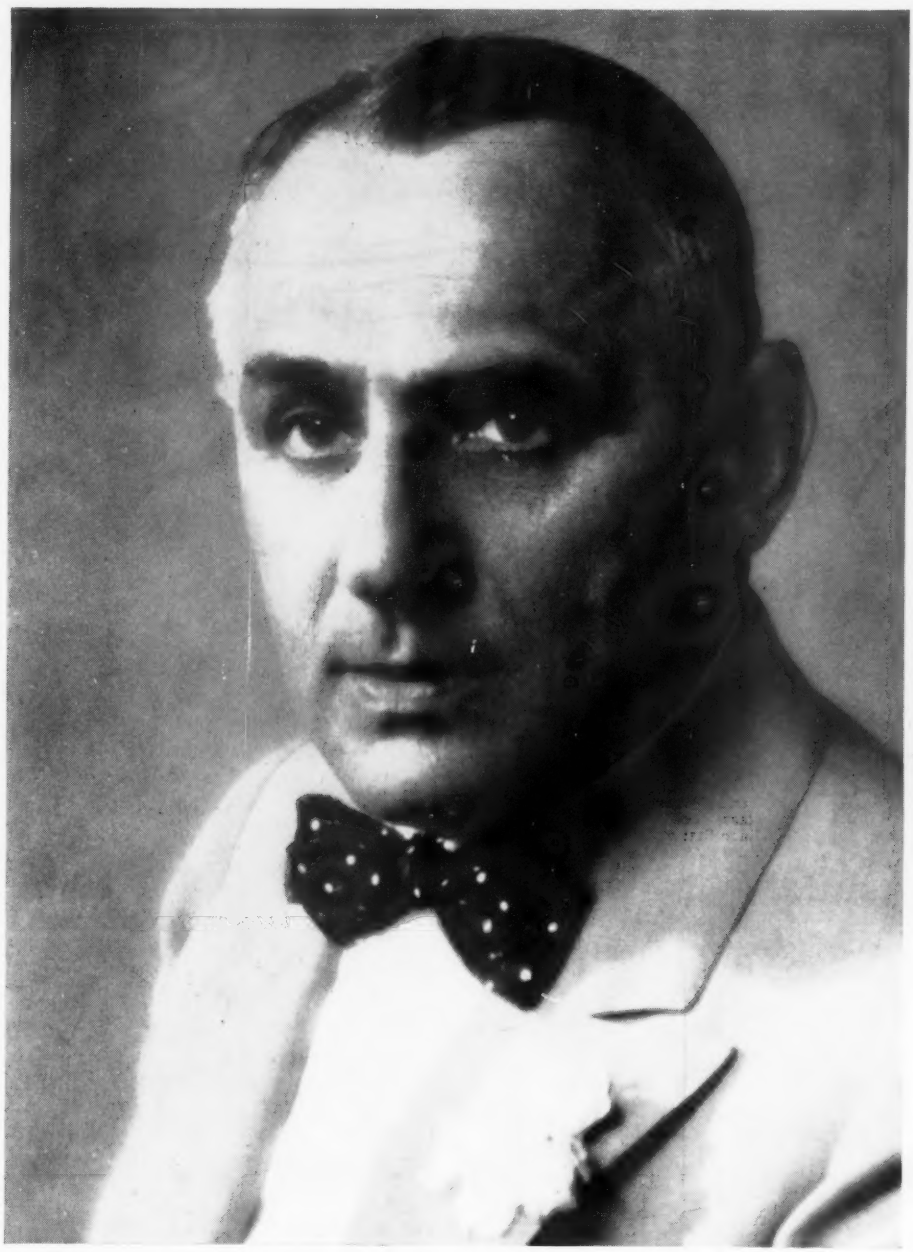
# THE BULLETIN

OF THE

## AMERICAN CERAMIC SOCIETY

Volume 20 APRIL, 1941 Number 4

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For story see page 134

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# THE BULLETIN OF THE AMERICAN CERAMIC SOCIETY

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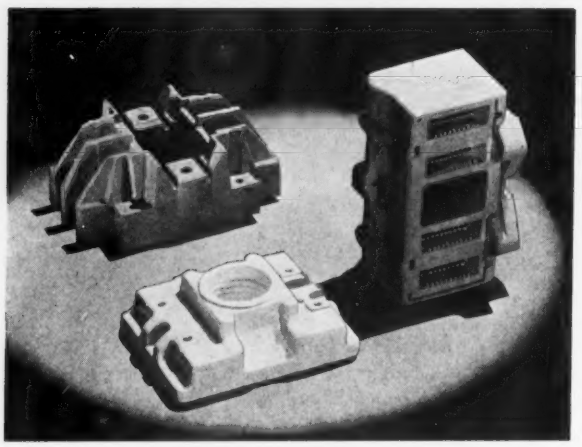

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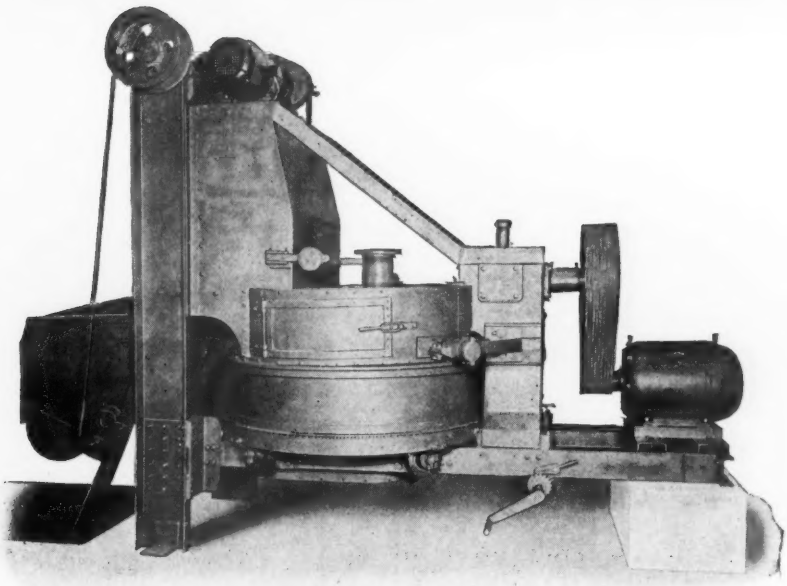

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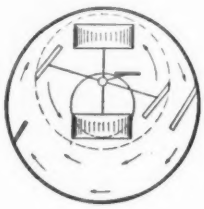

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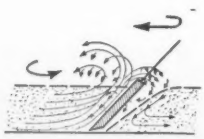

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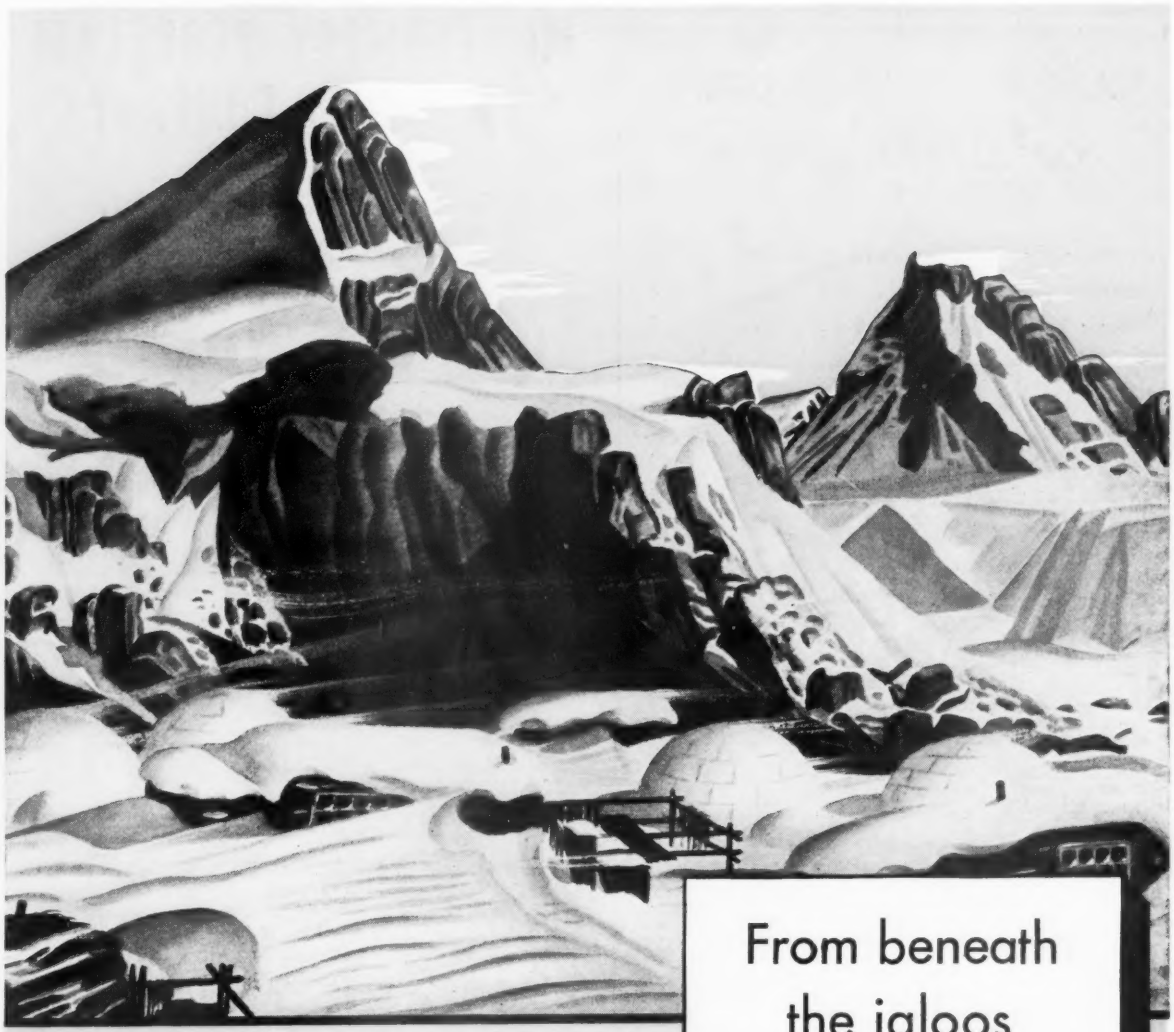

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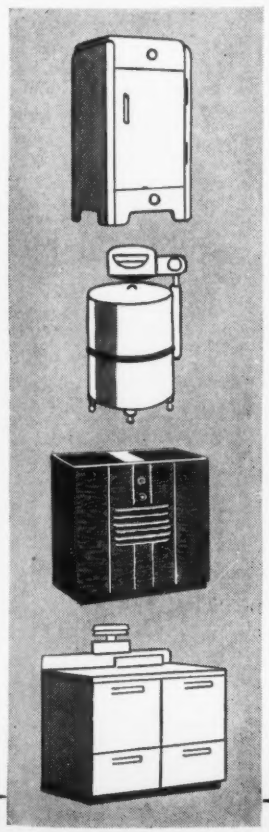

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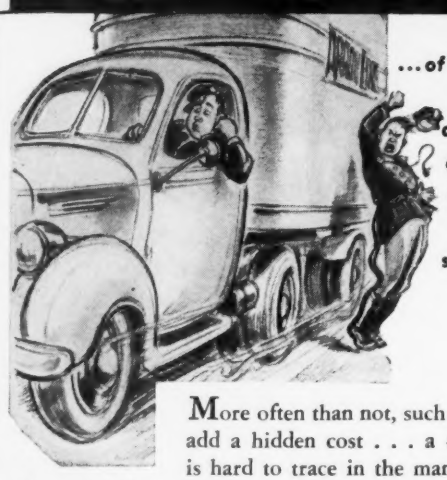
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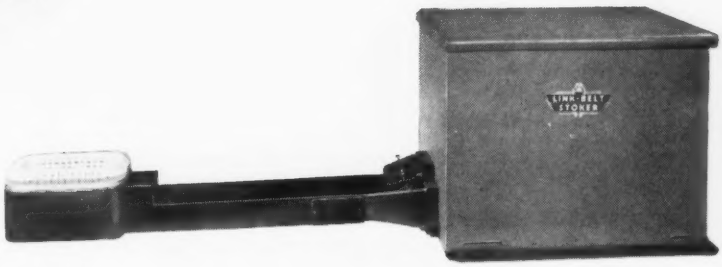

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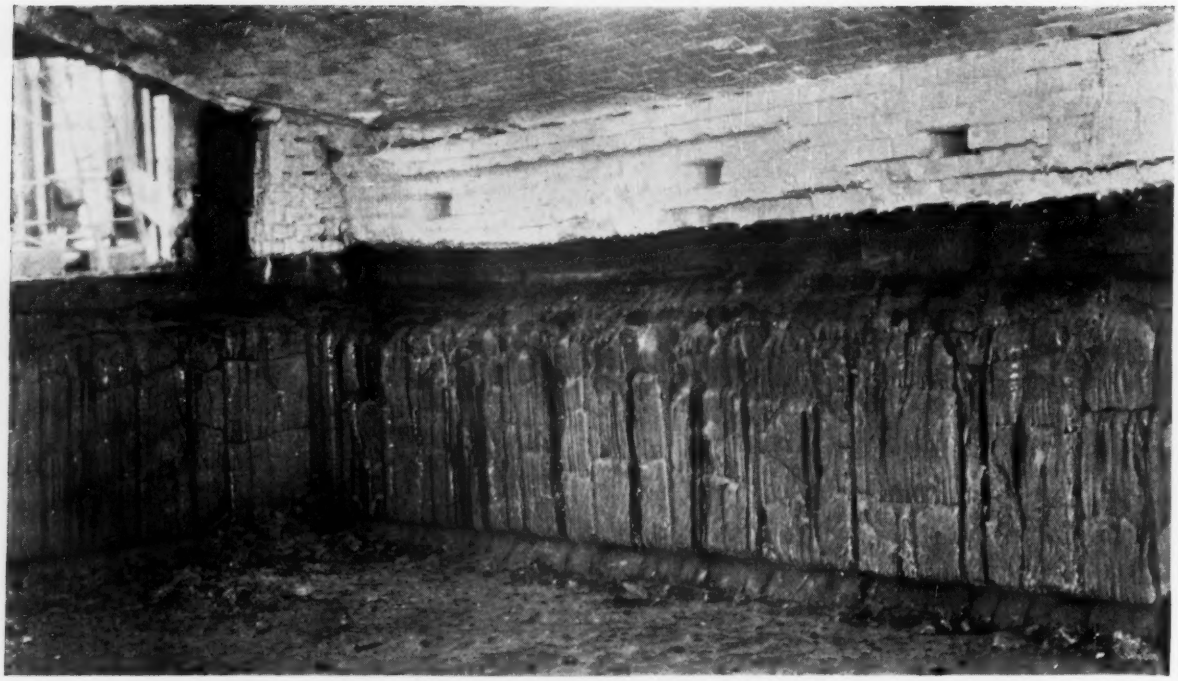

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| *Closed for repairs—November 28, 1940* | |
| *Melting-end size—18' x 29'—522 sq. ft.* | |
| *Total days of life* | 920 |
| *Operating days* | 839 |
| *Days idle for repairs, floods, etc.* | 38 |
| *Days idle for holidays* | 43 |
| *Total tons glass drawn* | 63,940 |
| *Tons glass produced per operating day* | 76.21 |
| *Sq. ft. melting area per ton per operating day* | 6.84 |
| *Tons produced per sq. ft. of melting area* | 122.49 |

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## OF THE AMERICAN CERAMIC SOCIETY

**A Monthly Publication Devoted to Proceedings of The Society and Promotion of Cooperative Research of Technical, Scientific, and Art Questions**

**Volume 20** **APRIL, 1941** **Number 4**


# PAPERS

## CENTRIFUGAL SLIP CASTING*


By C. R. Austin and G. H. Duncombe, Jr.



Abstract

Pieces simulating a round section centered over the foot of a standard dinnerware plate were made by centrifugal slip casting a semivitreous body. Observations on the characteristics of the slip used under these conditions and some of the characteristics of the cast pieces are presented. Centrifugal slip casting apparently offers interesting possibilities as a method to lessen the casting time and to lower the firing shrinkage of ceramic bodies.


### I. Introduction

A preliminary investigation has been conducted on the possibility of using centrifugal force to decrease the time required in casting dinnerware plates and the effects of such a process on the slip used and on the final body. An improvement in quality as well as a saving in time and in labor costs might be effected. Recent work by Gould and his co-workers[1] indicated that slip-cast plates had less tendency to warp during firing than plates of a similar body made by jiggering.

### II. Experimental Procedure

#### (1) Slip

A normal commercial semivitreous casting body[2] of the following percentage composition was used: Ky. ball clay 13, Fla. kaolin 6, N. C. kaolin 10, English china clay 24, feldspar 14, and flint 33%.

Two 4000-gm. batches were prepared by grinding 2000-gm. batches in No. 3 laboratory Abbé ball mills for 15 hours. Some alteration of the electrolyte and water content was made in the second batch in an effort to obtain a more fluid slip. The electrolyte variations used were as follows:

| Ingredient | Amount in slip, per cent of dry body weight | |
|---|---|---|
| | No. 1 | No. 2 |
| Water | 37.0 | 34.5 |
| "S" brand sodium silicate | 0.35 | 0.45 |
| Sodium carbonate | 0.05 | |
| Buromin* | 0.10 | |
| Sp. gr.† | 1.79 | 1.80 |

* A proprietary mixture containing +90% of $(NaPO_3)_6$.
† Determined by weighing 100 ml. of slip.

Slip No. 1 was used for the slow-speed centrifuge tests and in the normal casting-procedure tests; slip No. 2 was used for the high-speed centrifuge tests. Preliminary casting tests showed that the two slips had similar casting rates when they were cast in the normal manner.

#### (2) Molds

Plaster of Paris molds, with a $2^3/_8$-in. diameter face which simulated a round section centered over the foot of a standard dinnerware plate, were made to fit the cups of a laboratory centrifuge. Three sets of molds were made with the following plaster-to-water ratios:

| Set No. | Plaster-to-water ratio |
|---|---|
| 1 | 100:100 |
| 2 | 100:80 |
| 3 | 100:60 |

The dried molds were weighed, and compensating weights were added to make the total weight of each mold and centrifuge cup equal within ±3 gm.


* Presented at the Autumn Meeting, White Wares and Materials and Equipment Divisions, Uniontown, Pa., September 13, 1940. Received August 13, 1940.


[1] (*a*) R. E. Gould and G. W. Fichter, "Notes on Laboratory Experiments in Production of Flatware," *Jour. Amer. Ceram. Soc.*, **22** [7] 216–19 (1939).
(*b*) A. J. Hedquist, E. Wilson, and R. E. Gould, "Notes on Casting All-Kaolin Bodies," *ibid.*, **22** [7] 214–15 (1939).

[2] R. F. Geller and A. S. Creamer, "Investigation of Feldspar and Its Effect in Pottery Bodies," *ibid.*, **14** [1] 30–71 (1931); p. 50.

### (3) Centrifuge

The centrifuge* tests were made under two conditions, (1) at 1440 r.p.m., or 4900 ft. per min., and (2) at 2030 r.p.m., or 6900 ft. per min.† Approximately 20 seconds were required to reach full speed after the current was turned on, and approximately 15 seconds were required to stop the centrifuge after turning off the current.

* An International Equipment Company Series 1-Type SR-No. 1294 centrifuge was used in this investigation.

† The linear velocity was calculated at the clay-plaster interface by using $6^1/_2$ in. for the radius arm; r.p.m. were given by a revolution counter.

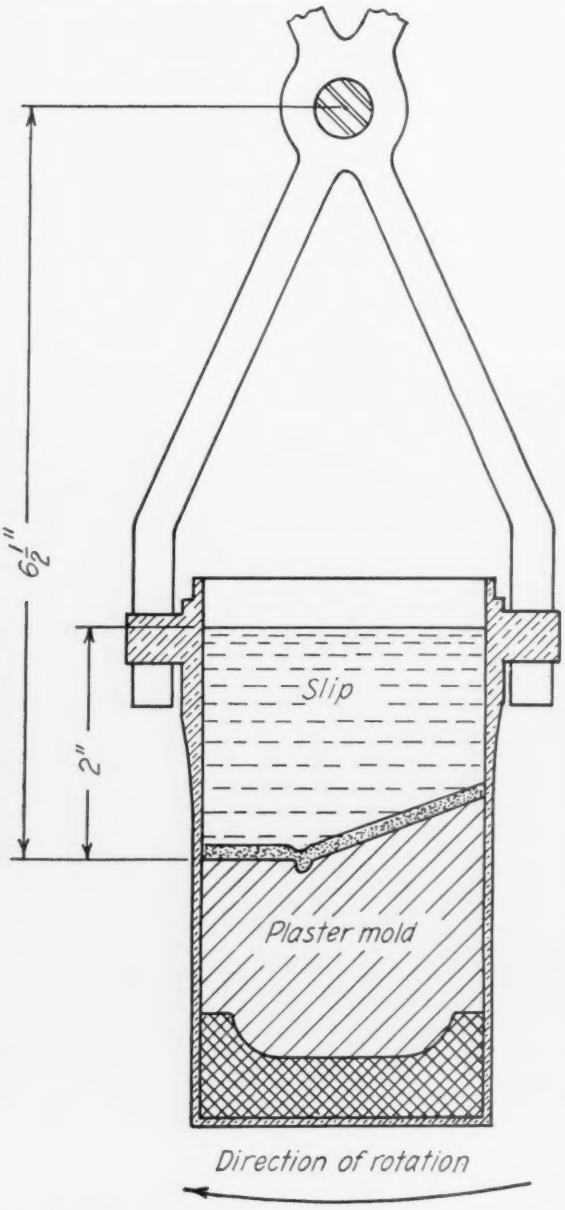


FIG. 1.—Top cross-section view of apparatus.

### (4) Casting Procedure

The molds were so placed in the centrifuge cups that the bead of the foot design was vertical when in motion, with the tapered rise of the lip as the following edge. A 2-in. depth of slip, that is, from the top surface of the slip to the heel of the mold, was poured into each centrifuge cup before starting the test. A schematic diagram is shown in Fig. 1.

Two molds of the 100:80 and one mold of the 100:60 and 100:100 plaster-to-water mix were used at each casting time and speed. The same molds were used for the corresponding casting times at the high and low speeds. The molds were dried overnight in an electric oven set at 90°C. with the door left open before the normal-casting, slow-speed, and high-speed tests.

After casting, the specimens were dried overnight at 90°C. The samples were then fired to cone 9 down in approximately $3^1/_2$ hours and were cooled in place to room temperature in 15 hours. The extreme shortness of the firing schedule was not important because the primary purpose of the test was the consolidation of the specimens so that thin sections might be made more readily.

## III. Results

Table I gives the results of the casting tests and the thicknesses of specimens after drying overnight at 90°C. Data on the fired specimens are given in Table II and Fig. 2. The values reported are the averages of the results obtained for any particular speed and time of casting, inasmuch as examination of the data indicated that the effect of the variation in the plaster-to-water ratios of the molds used was only of minor importance and did not change the general order of the results.

### (1) Petrographic Examination

A naked-eye examination of thin sections of centrifugally cast bodies, Nos. S-3 and F-1, which had a thickness closest to that of commercial dinnerware plates, showed slightly opaque bands of material at each surface of the test piece when they were fired to cone 9 down. The opacity was greater on the mold side of the test pieces. The edge of the band of opacity on sample No. S-3 was irregular, but the corresponding edge on No. F-1 was regular.

The wide center band of least opacity (under the microscope) apparently contained 20 to 40% more of the quartz mineral than the material in the opaque band next to the mold surface. No difference was noted in the amount of quartz in the large center zone and in the opaque zone away from the mold surface. The quartz crystals in the wide center zone of the test pieces were well distributed. The lower amount of the mineral quartz noted on the edge next to the mold surface probably was the result of the quartz in this section going into solution more readily than that in the interior because of the concentration of electrolyte at the mold surface, which normally occurs, combined with an exceptionally fast rate of heating.

TABLE I
CASTING AND DRY DATA

| Series No. | Centrifuge speed (ft./min.) | Centrifuging time (min.) | Time from fill to drain (min.) | Approx. draining time (min.) | Sp. gr. of slip* after casting | Dry thickness (in.) | | | Remarks (residue on top of slip after centrifuging |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Lip | Heel | Mean | |
| S-1 | 4900 | 1 1/4 | 3 | 10 | 1.80 | 0.088 | 0.096 | 0.092 | |
| S-3 | " | 3 1/4 | 4 1/2 | 10 | 1.77 | 0.179 | 0.273 | 0.226 | Black |
| S-10 | " | 10 1/4 | 12 | 20 | 1.74 | 0.381 | 0.539 | 0.460 | Black |
| F-1 | 6900 | 1 1/4 | 2 1/2 | 10 | 1.79 | 0.174 | 0.252 | 0.213 | Black (slight) |
| F-3 | " | 3 1/4 | 4 1/2 | 15 | 1.77 | 0.350 | 0.509 | 0.429 | Black (considerable) |
| F-10 | " | 10 1/4 | 12 | 75 | 1.65 | 0.814 | 1.051 | 0.932 | Black (large quantity) |
| N-10 | | Normal casting | 10 | | 1.79 | 0.107 | 0.107 | 0.107 | |
| N-120 | | Normal casting | 120 | | 1.80 | 0.346 | 0.351 | 0.348 | |

* Slip poured from cup after test.

TABLE II
DATA ON FIRED SPECIMENS

| Series No. | Centrifuge speed (ft./min.) | Centrifuge time (min.) | Firing shrinkage (%)* | | | Fired absorption (%)† |
|---|---|---|---|---|---|---|
| | | | Lip | Heel | Mean | |
| S-1 | 4900 | 1 1/4 | 10.2 | 10.4 | 10.3 | 3.9 |
| S-3 | " | 3 1/4 | 7.8 | 12.0 | 9.9 | 5.6 |
| S-10 | " | 10 1/4 | 8.9 | 6.1 | 7.5 | 4.5 |
| F-1 | 6900 | 1 1/4 | 8.6 | 7.9 | 8.3 | 6.8 |
| F-3 | " | 3 1/4 | 6.0 | 5.9 | 6.0 | 6.8 |
| F-10 | " | 10 1/4 | 6.5 | 6.4 | 6.5 | 6.7 |
| N-10 | Normal casting | 10‡ | 13.1 | 12.0 | 12.6 | 3.5 |
| N-120 | " " | 120‡ | 16.2 | 11.6 | 13.9 | 3.2 |

* Shrinkage calculated from 2 determinations of thickness of lip and of heel for each casting; determinations on each casting from each mold averaged for given speed and time of casting.
† Two-hr. water boiling test (specimens not broken).
‡ Time slip remained in mold.

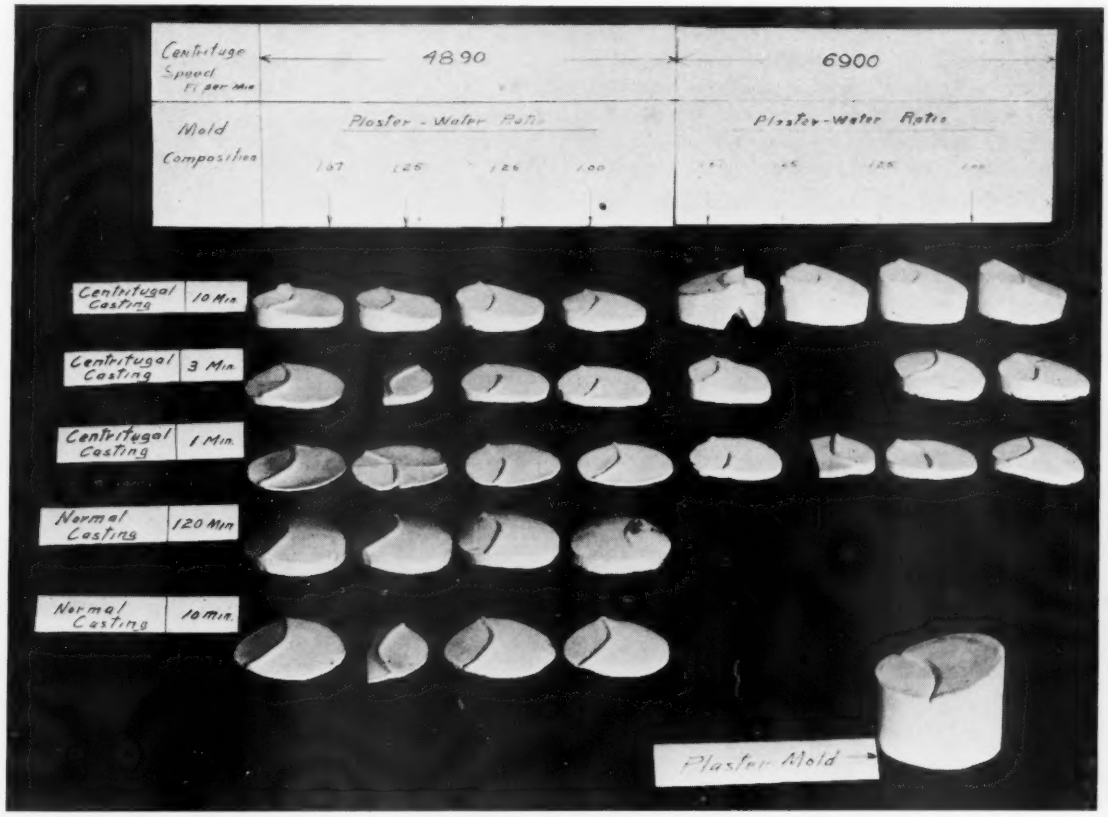


FIG. 2.—Fired specimens.

An examination with the naked eye of sample No. N-120 showed slight banding at each surface of the test piece, but a difference in mineral composition between these zones was not noted under the microscope.

### (2) Partial Chemical Analysis

A partial chemical analysis was made to determine more definitely whether segregation of slip constituents had occurred during the casting operation. The silica content was determined on samples taken from the top and bottom areas of sample No. F-10 (centrifugally cast at high speed for 10 min.), which had a minimum thickness of 0.7 in. as fired. The results were as follows:

| Sample No. | Silica (%) |
|---|---|
| From top area of F-10 | 74.8 |
| From bottom area of F-10 | 75.7 |

The greatest difference in specific gravity of the slip constituents occurs between the clay and flint, and if any segregation occurred, it should have been most prevalent in this sample.

## IV. Discussion

The data (Table I) indicated that, at slow speed by centrifugally casting, approximately the same thickness of material was built on the mold in $1^1/_4$ min. as required 10 min. by the normal process. A thickness was built in $10^1/_4$ min. at slow speed comparable to that obtained only after a period of 120 min. by the normal casting process. Approximately $3^1/_4$ min. at slow speed or $1^1/_4$ min. at fast speed built a thickness equal to that of the ordinary dinnerware plate.

Segregation of constituents apparently was not a serious problem inasmuch as specimens approximately four times as thick as ordinary dinnerware showed a difference of only 0.9% in silica content between the top and bottom surfaces.

The centrifugal slip-casting process lowered the specific gravity of the slip above the mold particularly when the longer time intervals were used. This problem might not be serious in making ware of a thickness corresponding to that of dinnerware, but serious difficulties might develop if thicker ware were to be made. Slip of higher initial specific gravity might give better results.

Some of the trials, particularly the thicker ones, indicated that the bottom of the centrifugally cast plate section was thicker than the rim. This was probably due to the marked difference in peripheral velocity and in the height of the column of slip above these two surfaces, which is inevitable when a small centrifuge (radius $6^1/_2$ in.) is used. Machines with a 2-ft. radius and a depth of 6 in. or more of slip above the mold surface should give much better results in this respect.

In trials which had a thickness comparable to or greater than that of ordinary dinnerware, the depression on the top surface of the plate above the foot was slight and sufficiently rounded so that no serious dishwashing difficulties might be expected.

The firing shrinkages of the centrifugally slip-cast specimens were smaller in general than for those cast in the normal manner.

Westman[3] studied the pressing of plastic clays and whiteware bodies in contact with water between permeable pistons and found that pressures of about 200 and 800 lb. per sq. in. were required to overcome the capillary suction of china clay and ball clay, respectively. Optimum results might be secured in centrifugal slip casting by using velocities and weights of slip sufficient to produce pressures in excess of 800 lb. per sq. in. The maximum pressure used in this work (at 2030 r.p.m.) was about 80 lb. per sq. in.

## V. Conclusion

Centrifugal slip casting apparently offers interesting possibilities as a method of decreasing the casting time and lowering the firing shrinkage of ceramic bodies.

#### Acknowledgment

Acknowledgment is made to W. C. Rueckel, formerly of the Battelle staff, and to J. D. Sullivan, Supervisor of the Ceramic Department, Battelle Memorial Institute, for suggestions and assistance. The authors also acknowledge the support of the work by Battelle Memorial Institute and permission to publish the results.

Battelle Memorial Institute
505 King Avenue
Columbus, Ohio

[3] A. E. R. Westman, "Effect of Mechanical Pressure on the Imbibitional and Drying Properties of Some Ceramic Clays, I," *Jour. Amer. Ceram. Soc.*, **15** [10] 552–63 (1932); II, *ibid.*, **16** [6] 256–64 (1933).

# TUNNEL DRIER REFINEMENTS*

By T. W. Garve

Abstract

The recommended innovations refer to the main intake flue, to the individual tunnel intakes, to the cross section of the drying tunnels, and to the doors of a progressive, waste-heat tunnel drier.

## I. Introduction

This discussion is limited to a single-track, waste-heat tunnel drier. The heat in this drier is more closely applied to the ware and the control is more effective than in the double- and multiple-track tunnel where the air passages between the rows of cars are wide, with a resulting loss of efficiency.

## II. Hot Air Intake Flues

Air blown into a flue follows a straight course to the end until it is backed up by pressure which forces the air into the side ducts successively from the rear to the front. Because the last tunnel would receive most of the hot air and the first tunnel the least, the flue in the eight-tunnel drier is divided into two equal parts by a thin metal partition (Fig. 1). As a result, exactly one half of the air is dispatched to the last four tunnels and the other half to the first four tunnels. In a twelve-tunnel drier, two or three such partitions would be used. This would greatly aid in obtaining uniform drying. To eliminate undue friction and to lessen the loss of velocity pressure in the flue and duct system, the corners of the duct walls are rounded.

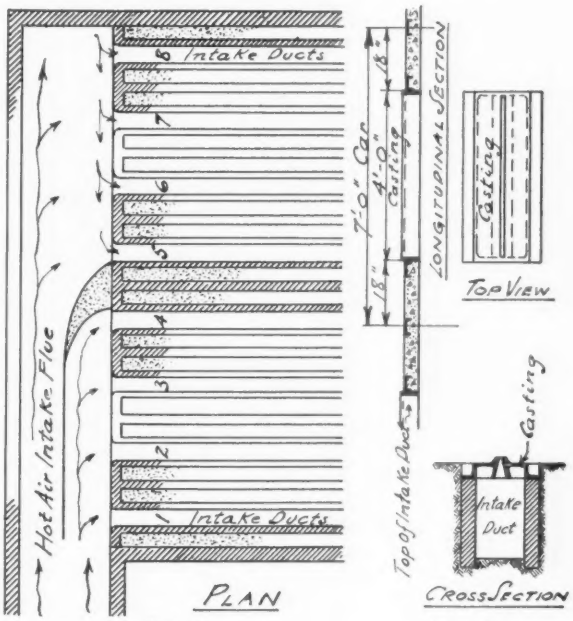


FIG. 1. FIG. 2.

## III. Tunnel Intakes

Between the cars, the intake ducts are covered with brick or concrete; beneath the cars, the ducts are covered with cast-iron plates which have an injector slot in the center, thus increasing the upward velocity of the gases (Fig. 2). The flat part of the plate will transmit heat by radiation to the lower part of the setting, and the injector slot will cause some impingement on the center of the lower deck. The spaces between the car and the tunnel walls ordinarily act as chimneys, drawing hot gases from under the car, whereas the nozzle effect of the injector slot directs the gases to the underdeck of the car and thus increases the velocity of the gases.

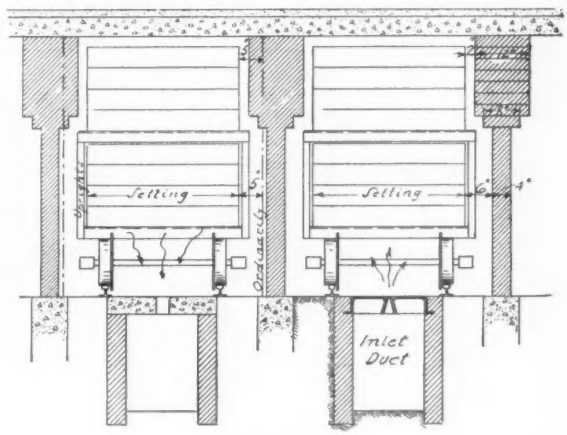


FIG. 3.

## IV. Drying Tunnels

In the narrowest tunnel practicable, there are usually about 5 inches of space between the ware and the tunnel wall. This gives too much free space through which the hot gases short-circuit. The drier described (see Fig. 3) has 6 inches of space along the lower deck and only 2 inches along the upper deck.

A 4-in. wall is used in the lower part of the tunnel overtopped with a 12-in. wall on an 8-in. corbel. Sufficient space is obtained in this way in the lower part of the drier tunnel, and the space in the upper part is narrowed. The restricted passage along the top deck tends to drive the air into the top setting as well as to the ware on the lower deck. This reservoir of hot air at the bottom of the tunnels results in more uniform drying. The ware on the bottom deck, moreover, will be dried first, which is the reverse of the results usually obtained in progressive tunnel driers.

* Presented at the Forty-Third Annual Meeting, The American Ceramic Society, Baltimore, Md., April 1, 1941 (Structural Clay Products Division). Received January 3, 1941.

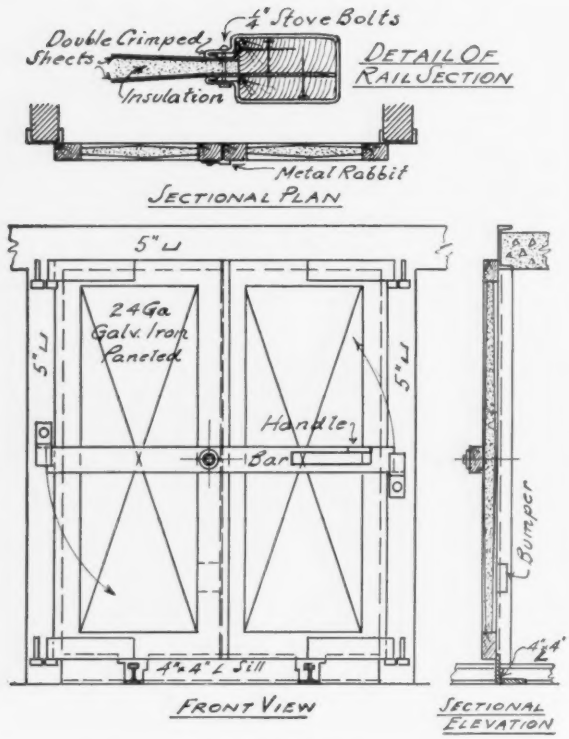


FIG. 4.

## V. Drier Tunnel Doors

The wooden door is a fire hazard, and the steel door is heavy, often bent out of shape, and heat radiating. Figure 4 shows a wooden door covered with galvanized iron and insulating material. One short sheet is wrapped around the wooden rail and has its edges crimped and bolted to the door sheets. One sheet is bent to an angle along the outer edge to fit underneath the frame-wrapping sheet and the other sheets fit into the two parts of the wooden rail. No wood is exposed. A short bumper is provided inside in the center, and the door fastening may be made to snap, allowing the doors to open without breaking if a car gets away. The door is fireproof, lightweight, well insulated, and inexpensive.

The sill or door butt is an angle iron. This is not important at the cold end of tunnels, but it is very important at the air intake end where the air is hot and under pressure and where the heat has to be conserved. The sum total of such details may indicate the difference between the success or failure of a drier, and in every case will result in an increase in efficiency.

314 KING AVENUE
COLUMBUS, OHIO

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# CONTROL OF IRON OXIDE IN VOLCANIC ASH*

BY E. D. KINNEY

ABSTRACT

One of the potential uses of volcanic ash is that of a component in glazes and low-cost glass for the ceramic industry. It is well suited for this except for the small amount of iron oxide present, which is sufficient to impart a bluish green coloration to the frit that usually becomes yellow or ivory colored when it is incorporated in a glaze and fired in an oxidizing atmosphere. The object of this study was to eliminate the influence of iron, either by its removal or through other means.

Mechanical and magnetic concentration and leaching were unsuccessful; satisfactory results, however, were obtained finally by using reagents in the melt to produce colors that would act in a complementary manner with the blue-green of the iron. Colorless or almost colorless glazes containing suitable amounts of ash may be produced at virtually no extra cost.

## I. Chemical Composition

The chemical composition of representative samples of volcanic ash are given in Table I.

The ignition loss on samples Nos. 1 and 2 represents occluded water and ordinary moisture (on No. 1, the moisture is 0.99%). The ignition loss on sample No. 3 represents occluded water, moisture, and an undetermined amount of carbon dioxide, the latter indicating that some of the lime is present as carbonate (probably of secondary origin).

## II. Physical Properties

Sample No. 1, McPherson County volcanic ash, was used in these tests. It is light gray and consists of an almost uniform mixture of finely divided particles of rock glass, which is a solid solution of silicates. Loosely coherent concretions of almost the same composition are also present, and a few scattered grains of feldspar can be observed under the microscope. The percent-

* Presented at the Forty-Third Annual Meeting, The American Ceramic Society, Baltimore, Md., April 2, 1941 (Art Division). Received November 28, 1940.

age of feldspar, however, is very small. A representative sample of volcanic ash is shown in Fig. 1.

TABLE I

CHEMICAL COMPOSITION OF SAMPLES OF VOLCANIC ASH*

| | Sample No. 1 (%) | No. 2 (%) | No. 3 (%) |
|---|---|---|---|
| Ignition loss | 5.00 | 4.60 | 4.60 |
| Alkalis $Na_2O + K_2O$ | 4.70 | 5.64 | 4.82 |
| CaO | 0.70 | 1.00 | 1.68 |
| MgO | 0.30 | 0.21 | 0.13 |
| $Al_2O_3$ | 14.15 | 14.46 | 10.65 |
| $Fe_2O_3$ | 1.65 | 1.54 | 2.65 |
| $SiO_2$ | 72.50 | 73.30 | 72.40 |
| Total | 99.00 | 100.75 | 96.93 |

* Sample No. 1, McPherson Co.; No. 2, Lincoln Co.; and No. 3, Meade Co. volcanic ash.

In Table II, the analyses of the ash and of the concretions are compared.

TABLE II

CHEMICAL COMPOSITION OF SAMPLE OF VOLCANIC ASH AND OF CONTAINED CONCRETIONS (%)

| | $SiO_2$ | $Fe_2O_3$ | $Al_2O_3$ | CaO |
|---|---|---|---|---|
| Ash | 72.50 | 1.65 | 14.15 | 0.70 |
| Concretions | 70.50 | 2.13 | 13.67 | 0.68 |

| | MgO | $K_2O + Na_2O$ | Ignition loss | Total |
|---|---|---|---|---|
| Ash | 0.30 | 4.70 | 5.00 | 99.00 |
| Concretions | 0.31 | 6.71 | 5.00 | 99.00 |

Probably 50% of the ash will pass through a 200-mesh screen and 20% will pass through 300-mesh.

A detailed discussion of the physical properties of the ash is given by Landes.[1]

## III. Concentration by Water

Inasmuch as the ash is a uniform mixture of complex particles of virtually identical composition, the removal of any constituent, such as iron oxide, by mechanical concentration has little chance of success, as was proved by actual tests.

## IV. Magnetic Concentration

The particles in the ash showed no trace of magnetism either before or after roasting which, under oxidizing conditions, changes the color of the ash from gray to red, owing to oxidation of the ferrous iron. There is no change under reducing conditions.

## V. Centrifugal Classification

A sample of the ash was sent by Plummer* to the Federal Pneumatic Systems, Inc., Chicago, Ill., for testing. Classification in this system is effected by opposing one centrifugal current of air to another. The results showed that, although the chemical constituents cannot be separated by this method, volcanic ash can be classified according to grain size.

FIG. 1.—Volcanic ash (natural size).

## VI. Leaching Tests

The leaching results were unsatisfactory. Generally speaking, neither the ash itself nor the iron is soluble in hot or cold acids or dilute alkalis. Repeated tests with 10% of sulfuric acid gave only a 13% extraction of iron oxide. This small amount of iron is probably present in the form of oxide coatings deposited by the infiltration of ferruginous waters. The iron present as silicate apparently is not affected.

## VII. Use of Decolorizing Agents

Four different mixtures, containing 5.18, 10, 15, and 20% of volcanic ash, respectively, were tested. These mixtures were essentially high alumina soda-lime glass batches, but when they were incorporated in a glaze, the batch ingredients were adjusted to produce a typical glaze formula. The mixtures were melted in 50-gm. lots in fire-clay crucibles in a gas furnace and were poured on a flat iron plate for observation.

The composition of the 5.18% ash mixture was flint sand 61.81, volcanic ash 5.18, soda ash 28.10, and whiting ($CaCO_3$) 4.91%. The results of the tests of this mixture are included in Table III.

The selenium in these tests was used under reducing conditions.

The composition of the 10% ash mixture was flint sand 50, volcanic ash 10, soda ash 30, whiting 5, and borax glass 5%. The results of tests on this mixture are included in Table IV.

The composition of the 15% mixture was flint sand 45, volcanic ash 15, soda ash 30, whiting 5, and borax glass 5%. The results of tests on this mixture are included in Table V.

[1] K. K. Landes, "Volcanic Ash Resources of Kansas," *Kans. State Geol. Surv. Bull.*, No. 14 (April 15, 1928); *Ceram. Abs.*, **7** [12] 861 (1928).

* Norman Plummer, State Geological Survey of Kansas.

TABLE III

RESULTS OF TESTS OF 5.18% VOLCANIC ASH MIXTURE*

| Test No. | Selenium (%) | Manganese dioxide (%) | Nickel oxide (%) | Color |
|---|---|---|---|---|
| 14 | | | | Pale bluish green |
| 15 | 0.001 | | | Colorless (best) |
| 16 | 0.002 | | | Slightly brown |
| 17 | | 0.002 | | Very slightly green |
| 18 | | | 0.002 | Pale bluish green |
| 21 | | | 0.004 | Pale grayish green |

* No cuprous oxide was used in these test specimens.

least volcanic ash to 0.33% in the glass containing the most. Only iron from the ash was included, but no doubt there were small amounts in the other substances.

(*a*) *Selenium:* Metallic selenium is used under reducing conditions. It produces a pink glass, owing to colloidal dispersion. Pink is complementary to green. In these tests, a slight excess would result in a brown color. The best results were obtained when enough selenium was used to give a faint brown; then arsenic trioxide to the amount of forty or fifty times the weight of selenium was added.

(*b*) *Arsenic trioxide:* This compound tended to eliminate the brown color owing to the necessary selenium, an excess of which would cause green to reappear. A quantity forty to fifty times the amount of

TABLE IV

RESULTS OF TESTS OF 10% VOLCANIC ASH MIXTURE

| Test No. | Se (%) | $MnO_2$ (%) | NiO (%) | $As_2O_3$ (%) | $Co_2O_3$ (%) | $CuO_2$ (%) | $KMnO_4$ (%) | Color |
|---|---|---|---|---|---|---|---|---|
| 29 | | | | | | | | Greenish blue |
| 30 | 0.002 | | | | | | | Greenish brown |
| 31 | 0.004 | | | | | | | Distinct brown |
| 32 | | 0.002 | | | | | | Bluish green |
| 33 | | 0.004 | | | | | | " " |
| 34 | | | 0.002 | | | | | " " |
| 35 | | | 0.004 | | | | | Gray-green |
| 36 | 0.001 | | | | | | | Brownish green |
| 37 | 0.0015 | | | | | | | " " |
| 38 | 0.002 | | | 0.02 | | | | Faint greenish gray |
| 39 | 0.0015 | | | 0.02 | | | | Faint green |
| 40 | | | | | 0.002 | | | Bright blue |
| 41 | | | | | | 0.002 | | Bluish green |
| 42 | 0.0015 | | | 0.04 | | | | Grayish green |
| 43 | 0.002 | | | 0 04 | | | | Faint grayish green |
| 44 | | | 0.003 | | | | | Greenish blue |
| 45 | | | | | | 0.003 | | Bluish green |
| 46 | | | | | 0.003 | | | Bright blue |
| 47 | | | | | | | 0.003 | Light bluish green |
| 48 | | | 0.005 | | | | | Grayish green |
| 49 | 0.001 | | | 0.02 | | | | Light green |
| 50 | 0.001 | | | 0.04 | | | | Very faint greenish gray (best) |

The composition of the 20% mixture was flint sand 40, volcanic ash 20, soda ash 30, whiting 5, and borax glass 5%.

The results of tests on this mixture are included in Table VI.

The color intensity is dependent on the thickness of the glass. The samples tested were at least 1/4 in. thick. When the mixture is applied as a glaze, the color intensity is much reduced.

## VIII. Summary and Conclusions

Attempts to remove the iron content of volcanic ash by concentration, by magnetic separation, and by leaching were uniformly unsuccessful, principally owing to the fact that the iron exists as a complex silicate in the ash.

Promising results, however, were obtained with the use of decolorizers. In these tests, selenium alone, for small amounts of iron, and selenium and arsenic trioxide, for larger amounts, proved to be by far the most effective. The amount of iron oxide (in terms of $Fe_2O_3$) ranged from 0.085% in the glass containing the

TABLE V

RESULTS OF TESTS ON 15% VOLCANIC ASH MIXTURE

| Test No. | Selenium (%) | Arsenic trioxide (%) | Color |
|---|---|---|---|
| 51 | | | Bright greenish blue |
| 52 | 0.0015 | | Light brownish green |
| 53 | 0.0015 | 0.08 | Light greenish gray |
| 54 | 0.003 | | Brownish green |
| 55 | 0.003 | 0.08 | Light gray-green |
| 66 | 0.003 | 0.12 | Pale grayish green (best) |

TABLE VI

RESULTS OF TESTS ON 20% VOLCANIC ASH MIXTURE

| Test No. | Selenium (%) | Arsenic trioxide (%) | Color |
|---|---|---|---|
| 56 | | | Strong greenish blue |
| 57 | 0.004 | 0.16 | Gray-green |
| 58 | 0.0045 | 0.20 | Light brownish green |
| 59 | 0.0045 | 0.25 | Grayish green |
| 60 | 0.0050 | 0.30 | Light grayish green |
| 61 | 0.0045 | 0.30 | Light pale green |
| 62 | 0.0055 | 0.30 | Light grayish green |
| 63 | 0.0043 | 0.220 | Grayish green |
| 64 | 0.0045 | 0.225 | Pale grayish green (best) |
| 65 | 0.0043 | 0.200 | Grayish green |

selenium added seems to be the correct amount. Arsenic trioxide is said to keep selenium from oxidizing.

(*c*) *Manganese dioxide and potassium permanganate:* These compounds tend to produce reddish purple shades. Their use is beneficial in counteracting small amounts of iron. A faint green melt is produced. If more iron is present, however, the effects are not satisfactory.

(*d*) *Cuprous oxide:* No beneficial effects resulted from the use of this compound. It decreases the green and increases the blue color.

(*e*) *Cobaltic oxide:* This compound produces a bright blue, which is no improvement.

(*f*) *Nickel oxide* ($Ni_2O_3$): This compound does some good by substituting a grayish green for greenish blue.

Little time was devoted to a consideration of other possible deoxidizers. The literature on the subject seems to be scarce; this field therefore probably offers opportunity for considerable research.

## IX. Cost of Decolorizers

The wholesale cost (spring, 1939) of selenium is $1.75 per lb.; arsenic trioxide costs $0.03 per lb. The cost of decolorizing one ton of a 10% volcanic ash glaze with the amounts of these substances required, as indicated in this report, would be about $0.06.

State Geological Survey of Kansas
Lawrence, Kansas

# EXAMINATION OF A CHINESE TEMMOKU GLAZE AND BODY*

By W. H. Earhart

Abstract

A fragment of authentic temmoku ware with the "hare's fur" glaze was obtained, and a microscopic examination of the body revealed it to be overfired, jet black in color, and composed essentially of clay, quartz, and an unidentified anisotropic crystalline material.

The glaze showed brownish red at the edges of splinters, but in thicker sections it appeared black and opaque. Studied in thin section, no trace of devitrification was found. A qualitative spectrographic analysis showed definitely the presence of iron, titanium, calcium, sodium, potassium, aluminum, silicon, and possibly magnesium.

## I. Identification of the Specimen

The fragment of temmoku that was studied was a potsherd which was generously supplied by James Marshall Plumer at the Institute of Fine Arts of the University of Michigan, Ann Arbor, Michigan. Professor Plumer identified the specimen as "from kiln site II near Shuichi, north of Chien-ning (-fu), Fukien province. It is datable as of the Sung dynasty (960–1280 A.D.) and may be considered as typical."

## II. Examination of the Body

The body was jet black in color and of such a vesicular structure that it resembled a fused black cinder more than a ceramic body. It had evidently been overfired under strongly reducing conditions. By boiling a few fragments in water for five hours, the absorption was found to be about 1%. Small white specks, granular in texture, were observed on fractured surfaces.

A microscopic examination of thin sections and of the powdered body revealed the presence of considerable quartz, an unidentified inert mineral, and a black, densely opaque background. The latter was presumed to be clay colored black by carbon or some other agent, as profuse crystals of mullite extended into the glaze at the glaze-body interface. This mullite development was not observed where the glaze contacted either the quartz or unidentified mineral in the body. The glassy phase in the body was conspicuous by its almost complete absence, although there was some glass development in the vicinity of a few quartz grains. The relative amounts of the three body constituents were roughly estimated from the thin sections to be black clay 50, quartz 30, and unidentified mineral 20%.

Owing to its finely granular structure, the exact optical properties of the unidentified mineral could not be definitely ascertained. There were indications, however, that it was biaxial positive ($Bxo < O_N$) with a mean index of refraction of between 1.53 and 1.54. With Bxa emerging, the birefringence was very weak, and the optic angle was probably small because the hyperbolas were quite distinct and did not leave the field of view when the stage was rotated. The material was colorless.

## III. Examination of the Glaze

The outer glaze surface was streaked with streamers of brown and greenish black, as if two immiscible colored glasses had run down the sloping surface of the piece. The glaze collected as a continuous bead or collar around the piece just above the base. The base itself was unglazed and of a brown color.

Fragments of the glaze, chipped from the body, appeared to be an opaque black, but when they were held to the light they showed a reddish brown color on the translucent edges, similar to the color shown by glasses high in ferric iron oxide.

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In thin section, the glaze was observed to be a clear, homogeneous glass of a light brown color. The index of refraction was 1.545. Crystals of mullite extended from the black clay of the body a short distance into the glaze. Where the glaze was in contact with grains of quartz or with the unidentified mineral in the body, there was no mullite or other crystalline development and very little, if any, solution appeared to have taken place. No crystal formations (devitrification) were observed in any part of the glaze itself except at the glaze-body interface. This indicates that the "hare's fur" effect was not due to devitrification (or crystallization) of the glaze. There appeared to be a very slight brownish intensification of color, however, at the outer glaze surface, indicating that the "hare's fur" effect could be due to a surface coloration such as might be produced by a highly oxidized zone of iron or a zone richer in iron than the inner glaze.

A qualitative spectrographic analysis of the glaze chipped from the body established the fact that it was composed of the elements, sodium, potassium, calcium, aluminum, silicon, iron, titanium, and possibly magnesium.

The glaze had just begun to resoften when a section of the ware was fired to cone 12 in a tunnel kiln under oxidizing conditions. Glasses in general will resoften at a lower temperature than that at which they were originally melted so that it may be assumed that this ware was originally fired higher than cone 12. All of the "hare's fur" effect had disappeared in this refiring, and the glaze had a dark brown, metallic, gun-metal appearance. When the same section was fired again to cone 16, the body softened and completely collapsed and the glaze had become so fluid that almost all of it had run off the body and soaked into the base in which the section was set. The glaze gave no indications of any "hare's fur" development where it still remained on the body. The black sectional surface of the body itself had become a chocolate brown color in the firing at cones 12 and 16, but freshly fractured parts of the fired body were still the black color observed on the original section.

## IV. Discussion and Conclusions

This ware was apparently produced from a mixture of powdered quartz, another nonplastic, inert mineral, and a washed plastic clay, possibly a clay of the stoneware type. A natural stoneware body, however, may have been used. A potash-soda-lime-alumina-silica glaze containing appreciable iron and titanium oxides was then applied, and the ware was fired to a temperature higher than cone 12 and lower than cone 16.

It appears that strong reducing conditions prevailed from the start of firing and were maintained at least up to a point where the body was sufficiently well vitrified to prevent any oxidation taking place. Initial fusion of the glaze under strongly reducing conditions would also tend to seal the body effectively from any oxidizing conditions subsequently employed. The black color of the body seems to be due to unoxidized carbon, derived either from organic matter originally in the clay or deposited in the body by a smoking, reducing flame during the early stages of firing. It seems probable that neutral or oxidizing conditions existed during the later stages of firing, as the color of thin slivers of glaze was the reddish brown which is characteristic of iron-bearing glasses melted under oxidizing conditions so that the iron is in the ferric form.

### Acknowledgment

The author wishes to acknowledge his indebtedness to Professor James Marshall Plumer of the University of Michigan for supplying the authentic specimen and the photographs used in this investigation and also the assistance of Edwin Hodge of Ohio State University in making the spectrographic analysis.

42 Orchard Lane
Columbus, Ohio

Chinese "oilspot" temmoku teabowl.

Chinese "hare's fur" temmoku teabowl (top view).

# ENGINEERING CONTROL OF DUST WITH SPECIAL REFERENCE TO RESPIRATORS*

By A. D. Brandt

Abstract

The more common methods of reducing or controlling the respiratory hazard caused by dust are discussed. The specific methods are (1) control of dust at the point of dust generation, (2) isolation of dusty processes, (3) substitution of nonhazardous processes, and (4) reduction of dust in inspired air by respiratory protective devices. The general methods are (1) general ventilation, (2) good housekeeping, and (3) a rigid inspection of all control devices. A detailed discussion is given of respirators, their proper use, construction, maintenance, and Bureau of Mines approval.

## I. Introduction

Methods of dust control are not new, but the proper application of engineering principles to such methods is lacking in many cases. Some industries are reluctant to call in qualified engineers to lay out their dust-control plans. No one method, design, or device will solve the problem for all industries or in one large industry, and only a thorough study of the existing conditions can give the engineer a basis on which to determine the best method or combination of methods for the problem or industry in question.

The important methods of dust control are (1) control at the point of generation or dissemination, (2) isolation of dust-producing processes, (3) substitution of less hazardous materials, and (4) reduction of dust in inspired air by means of respirators.

## II. Control at Point of Generation or Dissemination

The methods commonly used to control dust at the point of origin are (1) local exhaust ventilation equipment, (2) water or other suitable liquids, and (3) good housekeeping. A local exhaust ventilation system consists of (1) exhaust hoods, (2) air ducts, (3) collector, and (4) fan.

### (1) Hoods

The purpose of an exhaust hood, which is the vital part of the system, is not to create "suction" but to produce air currents in the area of dust generation of suitable magnitude and acting in the proper direction to overcome the energy of the escaping particles and to carry them into the exhaust system. A knowledge of the laws of air flow into suction openings of various shapes is therefore essential to proper design. A thorough understanding of the way in which dust is generated is also necessary, especially as it pertains to particle size and to the velocity at which the particles are thrown off. An efficient hood collects the dusts generated with a minimum air flow from the ineffective or clean air areas and with minimum power consumption. A hood is properly designed when it (1) is efficient and (2) does not hinder the operation of the tool or machine.

### (2) Ducts and Collector

The ducts include all piping through which the dusts are carried from the hoods to the collector by the air current created by the fan. The final part of the system is the collector, which retains the dust and permits the clean air to escape into the atmosphere.

Routine inspection and maintenance are important. The ducts are clogged all too frequently with worn-out overalls or similar waste materials; properly designed systems are unbalanced by having the tinsmith put in additional branch ducts and exhaust hoods; collectors are not emptied; and bags of collectors are torn or even removed and not replaced. Inspection and maintenance can ensure successful operation for a reasonable period of time.

### (3) Fan

To avoid the wear of fan blades and housing resulting from the abrasive action of the dust, the collecting unit should be located on the suction or upstream side of the fan.

### (4) Spray

Wetting down with water by hand or by sprays or streams is a method of control at the point of origin that is widely used. Water helps temporarily to lay dust, and a stream carries away many particles, but the procedure is fundamentally impracticable as an effective safeguard. It is impossible to wet most of the particles by the usual means owing to the gas layer which envelops them. Few particles are collected and consequently many of those that are temporarily wetted will remain in suspension owing to evaporation of the surrounding layer of water before complete settling has taken place. When other methods are not available or are impracticable, however, the use of a water stream is worth while.

### (5) Good Housekeeping

Good housekeeping as a means of dust control is possibly the least difficult and least expensive to employ and frequently accomplishes remarkable results. It prevents dust accumulations in any part of the plant where the dust may be redispersed by careless operation, shock, or wind currents. Such dust may be wetted down and removed frequently and permanently. Frequent and regular use of large vacuum cleaners on

* Presented at the Forty-Second Annual Meeting, The American Ceramic Society, Toronto, Canada, April 8, 1940 (General Session on Toxicology). Received April 9, 1940.

beams, rafters, or other inaccessible places is also helpful in solving this problem.

### III. Isolation of Dust-Producing Processes

The isolation of dust-producing processes limits the exposure to a few men who may be protected by respirators. The inclosure of these processes in dust-tight chambers or rooms, such as abrasive blasting cabinets, is effective. The chambers and dust-control devices, however, must be kept in good working condition to maintain their effectiveness.

### IV. Substitution of Less Hazardous Materials

The substitution of less hazardous materials offers an absolute method of dust control, but extensive changes in the manufacturing process are often required which may not be practicable. This method should not be recommended unless or until it is established that the quality of the manufactured item will not suffer by such change. The replacement of sandstone grinding wheels by artificial abrasive wheels and sand by steel shot in abrasive blasting has effected a substantial reduction in the silicosis rate of the pertinent industries.

### V. Use of Respirators for Reduction of Dust in Inspired Air

Respirators are misused and abused more than any other dust-control device.

The amount of dust in the inspired air may be reduced to a safe value by suitable respiratory protective devices. These alone are not the solution to many of the dust-control problems in industry, but they are a necessary and helpful adjunct to other methods. Although there are a number of different types of respirators, the two types which are used most commonly in dust control are (1) the mechanical filter or dust respirator and (2) the supplied-air or air-line respirator and abrasive blasting helmet. These respirators are used extensively on jobs such as abrasive blasting, paint chipping, handling used storage battery plates, cadmium oxide manufacture, welding operations, spraying of paints and glazes, and manufacture and use of pigments and dyes. Their most important use is found under conditions where protection is required intermittently, as in cleaning-out operations; sweeping; after blasting; removing cores from large foundry castings; shoveling, screening, and handling of materials; and the operation and maintenance of processing equipment.

Respirators should not be considered to be part of the worker's wearing apparel. They are safety devices and should be supplied by the employer. The employer, moreover, must see that they are distributed to all employees who need them, and he must tell the workers when and how to use them, which is a difficult task and is accomplished only by incessant instruction.

#### (1) Mechanical Filter Respirators

When the mechanical filter respirator is worn on a man's face, a certain percentage of the dust is filtered out from the inspired air. The air movement through the filter is produced by the respiratory action of the wearer. A filter respirator which is to be accepted by industry as satisfactory should (1) be comfortable and fit the face well, affording an air-tight contact between the face and the mask, (2) have little or no interference with vision and permit the use of glasses or goggles, (3) have a highly effective filter which is not bulky, (4) have low resistance to breathing over a period of use, (5) have small dead air space, and (6) have both inhalation and exhalation valves.

Dust respirators are usually constructed of a rubber or part-rubber facepiece and a filtering medium of felted or paperlike material. Exhalation valves are now almost universal, and inhalation or check valves are supplied in most respirators. Inhalation valves are intended to prevent (1) rebreathing exhaled air and (2) the humid exhaled air from getting into and fouling the filter. Rebreathing exhaled air, which has a high carbon dioxide content, induces panting and causes the wearer to think that there is a lack of air or that the resistance to breathing is high. He will attempt many solutions to eliminate these difficulties, all of which will seriously impair the performance of the respirator.

#### (2) Supplied-Air Respirators or Helmets

The air-line respirator and the abrasive blasting helmet are the supplied-air devices most commonly found in industry. The respirator consists of a face mask with an attached hose or rubber tube through which air is supplied, and the air is pumped or blown from a source of clean air to men in the various exposures. These devices afford positive protection if they are properly installed and maintained. The intake to air-supply systems used for this purpose must be located at a point where the air is clean and where it will not be contaminated by dust from nearby buildings. For the removal of oil, water, and odors from the air, a good air cleaner or purifier should be installed in the supply line. The cleaners, however, do not remove carbon monoxide which may be given off in antiquated or worn compressors. To avoid the possibility of carbon monoxide poisoning in men wearing supplied-air respirators, it is imperative that the air pump or blower should receive adequate routine inspection and periodic overhauling.

The abrasive blasting helmet completely incloses the wearer's head, forming a seal at the neck and shoulders or having a directly connected cape which may be tucked in under an over-all jacket or may be even extended to the waist. Blasters move about very little, but the helmet should be light in weight and the window or port which affords vision should be large and correctly placed. If the helmet is too small, a large volume of air must be supplied to prevent an undesirable decrease in the pressure within the helmet when the wearer inspires. The volume of air supplied to a helmet should be sufficient to provide a continuous leakage outward. Some helmets require only about 100 liters per minute; others require twice this amount. The air should be wasted through the collar or down around the neck and out through the clothing. Collars should be permeable to air to eliminate the possibility of building up a dangerous pressure within the helmet.

Exposed escape valves are unsatisfactory because dust from a blast may easily be driven into the helmet against a strong air current.

### (3) Selection of Respirator

The hazards as well as conditions of use of respirators in industry are many and varied. It is as illogical to recommend the same respirator for all purposes as it is to expect to find a respirator specifically designed for each different operation. No worker would use the same respirator for hay-fever prevention that he would wear if he were exposed to a dangerous concentration of quartz. In the selection of the proper respirator for any particular operation, the buyer should specify the conditions as fully as possible when asking for recommendations from respirator manufacturers or from the U. S. Bureau of Mines.

### (4) Care and Maintenance of Respirators

Because the use of respirators, compared to other methods of dust control, is inexpensive, little or no thought is given to their maintenance. Only too frequently good respirators are purchased, distributed carefully, and then forgotten, and in a short time they are dirty and function ineffectively.

The respirator will soon become defective if it is not properly maintained and will fail to give the necessary protection, even if it is worn correctly and continuously. A defective respirator, moreover, is worse than none because the wearer is given a false feeling of security and will not exercise the precaution which he would take if he had no respirator.

Individual and central maintenance are the two general systems of respirator maintenance in use today. In the individual maintenance system, the care and upkeep of the respirator is left to the user, who must wash, sterilize, and repair the respirator. In the central maintenance system, all respirators are assembled at one central point for cleaning and repairing.

The central maintenance system usually is worked out somewhat as follows. Each worker who needs respiratory protection is supplied with two respirators which are marked with the employment number of the user by stamping the number on metal parts, riveting metal number plates on the rubber masks, or sewing laundry tabs on the headbands. When he goes to work in the morning, the worker passes by a row of pigeonholes in one of which (indicated by his employment number) he finds a clean and well-kept respirator. At the close of the shift, he again places the dirty respirator in the pigeonhole. All of the dirty respirators are collected by one man who cleans and repairs them in a room laid out for this purpose. One respirator per worker is sufficient if the maintenance is carried out between shifts. Two respirators usually are supplied, however, and the repairs and cleaning are done by one man on the regular shift. The worker in charge of the respirator maintenance need not be a new or special worker. He may be the man in charge of the stock room or any individual whose work will permit. The maintenance of respirators may frequently be combined with that of such equipment as goggles and protective hats. In some industries where relatively few respirators are in use, the maintenance is one of the duties of the nurse.

The advantages of the central over the individual system are obvious. Each worker has a clean, well-kept respirator daily. He will object less to wearing it and will get real protection at all times. The monetary saving effected by the increased life of the parts and decreased need for new respirators usually will more than offset the additional cost (if any) of setting up and maintaining the central system. The idea of a central maintenance bureau is not a new one. Such bureaus have been in use in a number of industries for several years. The results produced are remarkable, as evidenced by the condition of the respirators and the apparent satisfaction of the users.

Respirator maintenance usually consists of cleaning, sterilizing, and repairing. Effective methods of cleaning and sterilizing are (1) wash in warm water with a brush and soap; (2) immerse for ten minutes in a solution of formalin, made by placing 1 part of 40% formaldehyde solution into 9 parts of water; (3) dip in a 3% solution of carbolic acid, a 2% solution of lysol, or a 70% solution of denatured alcohol; or (4) subject the respirator to sterilization by a moist atmosphere of antiseptic gas, preferably formaldehyde, for a period of 10 minutes at room temperature. After following any one of these procedures, the respirator should be rinsed with water and hung up to dry. The filters, felt screens, and headbands (if elastic) must be removed before cleaning or sterilizing the respirator.

Many dust respirators employ so-called "long-life" filters which are intended to be used over and over. Such filters are cleaned by blowing the dirt or dust off with compressed air, by brushing the surface, or by tapping the filter. If the filters are moist, they must be dried before the dust can be removed effectively. The filters may be dipped in a dry-cleaning solution for a short time to remove grease and the like. This process, however, should be carried out only infrequently because it decreases the life of the filter.

## VI. Bureau of Mines Approval

Dust respirators are tested and approved by the U. S. Bureau of Mines under Schedule No. 21 entitled "Procedure for Testing Filter-Type Dust, Fume, and Mist Respirators for Permissibility," and supplied-air respirators are tested and approved under schedule No. 19A entitled "Procedure for Testing Supplied-Air Respirators for Permissibility."

The only important difference between the air-line respirator and the abrasive blasting helmet is that the latter provides protection to the face and head of the wearer from the rebounding abrasive.

Seven supplied-air respirators of this type are approved; two are air-line respirators and five are abrasive blasting helmets.

The U. S. Bureau of Mines, through these approval schedules, has done a great deal to raise the standards of the respiratory protective devices manufactured in the United States and has been of great service to industry in the selection of the proper devices.

WILLSON PRODUCTS, INCORPORATED
READING, PENNSYLVANIA

# RECENT LEGISLATION ON OCCUPATIONAL DISEASES*

By Theodore C. Waters

Abstract

The history of occupational disease legislation is outlined, the laws and amendments enacted by the states in 1939 and 1940 are previewed, and trends of legislative developments as well as federal legislation are discussed. The purpose of the Murray Bill, in particular, brought up before Congress in 1940, is also considered in detail.

## I. History of Occupational Disease Legislation

The first state workmen's compensation acts held by the courts to be constitutional were enacted during 1911 and, since that time, all of the states except Mississippi have enacted such laws. Prior to their enactment, an employer's liability to his employees for injuries arising out of and in the course of their employment was that imposed by common law. The employee's right to recover for injuries so sustained was dependent on proof of the employer's negligence, and the common-law defenses available to the employer were (1) employee's assumption of risk, (2) employee's contributory negligence, and (3) negligence of employee's fellow servants.

With the enactment of these laws, the contractual relationship between the employer and the employee changed. The employer became liable as an insurer for accidental injuries to his employees, and compensation for such injuries was awarded, irrespective of any element of negligence that might be involved in the claim.

The compensation acts, generally speaking, were construed by the courts to apply solely to accidental injuries and not to occupational disease injuries, although in some of the states the courts held that occupational diseases in certain instances were compensable under the statutes. In those states whose courts construed the compensation acts as providing compensation solely for traumatic injuries, legal confusion arose as to the availability of the employee's common-law remedies for occupational disease injuries sustained during the course of employment. The courts of some states held that an employee had no common-law right of action for occupational disease injuries; such right of action was recognized in other states where the employer was permitted to interpose the common-law defenses in actions involving such claims.

A considerable amount of common-law litigation has developed in recent years throughout the country involving claims for occupational disease injury. This procedure has proved complex and generally unsatisfactory for the determination of the issues, and its cost has proved to be out of proportion to the benefits sought. Recognizing the need for a better method to determine these disputes, most of the industrial states have amended their compensation statutes to provide compensation for occupational disease injuries; California and Wisconsin were the first states to so amend their laws in 1919. From 1919 to 1930, similar amendments were made by six other states,[1] the District of Columbia in 1928, and from 1930 to date by sixteen additional states.[2]

In New Hampshire, Oregon, Tennessee, Texas, and Utah, legislative resolutions have been passed authorizing the appointment of commissions to study the problem of occupational disease legislation, and these commissions will probably submit their reports to the next sessions of their state legislatures for their consideration.

## II. State Occupational Disease Laws and Amendments Enacted During 1939 and 1940

Arkansas, Idaho, and Maryland enacted occupational disease compensation statutes in 1939, but the effective date of the Arkansas Act was suspended by the filing of a referendum, which suspension continued until November 5, 1940, when the Act was submitted to the voters for approval or rejection. The law was approved and is now effective. These three state acts are essentially similar in form. Each adopts a schedule of the occupational diseases compensable under the law, provides for the creation of a medical board to which must be referred all cases involving controverted medical questions, and makes special provisions for the pneumoconioses. They likewise emphasize the need for the prevention and control of occupational diseases by assigning to the proper state departments special duties and powers designed to carry out this purpose.

In Massachusetts, occupational diseases have been compensable since 1932, and in 1939 an important amendment to that law was enacted which provides compensation for employees in the granite industries who contract silicosis or other pulmonary dust disease. This law became effective August 12, 1939, and contains, among others, the following provisions:

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[1] Connecticut, 1927; Minnesota, 1927; New Jersey, 1924; New York, 1920; North Dakota, 1925; and Ohio, 1921.

[2] Arkansas, 1939; Delaware, 1937; Idaho, 1939; Illinois, 1936; Indiana, 1937; Kentucky, 1934; Maryland, 1939; Massachusetts, 1932; Michigan, 1937; Missouri, 1931; Nebraska, 1935; North Carolina, 1935; Pennsylvania, 1937; Rhode Island, 1936; Washington, 1937; and West Virginia, 1935.

(1) Compensation is denied for partial disability.

(2) The law adopts a schedule of progressive limitation of monetary liability, providing that if incapacity or death occurs within the first calendar month the Act becomes effective, the compensation payable shall not exceed the sum of $550 with monthly increases of $50 until a maximum limitation of $3000 is reached.

(3) Compensation shall not be payable for incapacity or death unless resulting within three years after the date of last exposure or, in death cases, unless death follows continuous total incapacity from such disease, commencing within the three-year period and resulting within seven years after the last exposure.

Occupational diseases have been compensable in Ohio under a statute adopted in 1921. In its original form, this was a so-called "schedule" law and listed the diseases for which compensation might be awarded. Silicosis was added to the schedule by amendment in 1937.

The Ohio Supreme Court, prior to 1939, had ruled that an employee had no common-law right of action for occupational disease injuries sustained by him during the course of employment. In the case of *Triff v. National Bronze and Aluminum Foundry Company*, 20 N. E. 2nd, Vol. I of Advance Sheets, page 232 (decided by the Ohio Supreme Court on March 29, 1939), the question was again presented to the Court as to whether or not an employee had such a common-law right of action, and the Court overruled its previous decisions denying the existence of such right. Pursuant to this decision, the Compensation Act was amended by adding to the schedule of compensable diseases a new item, No. 23, providing compensation for "all other occupational diseases." This amendment also abolished common-law rights of action for occupational disease injuries unless they were instituted within 180 days after the effective date of the Act, namely, May 26, 1939.

Pennsylvania enacted an occupational disease compensation act in 1937, which was held by the Supreme Court of that state to be unconstitutional in the case of *Rich Hill Coal Company, et al., v. Bashore*, 334, page 49. Effective October 1, 1939, the Pennsylvania Legislature re-enacted this statute, making compensable the same diseases set forth in the schedule of the law of 1937. The new law also created a medical board to which are assigned all cases involving controverted medical questions, and this board decides and files with the Compensation Bureau the following determinations of fact:

(1) Whether or not the claimant is suffering from the occupational disease alleged to have been sustained and, in death cases, whether or not death was caused by such disease.

(2) Whether or not the claimant has contracted or is suffering from the occupational disease alleged, together with its opinion as to the extent of disability of the claimant.

(3) Findings on such other medical facts as appear warranted by the evidence.

The reports and findings of the medical board are conclusive, except that, on appeals to the courts, the courts may inquire into the question of whether the findings were based on sufficient competent evidence.

At the 1940 session of the New York Legislature, an important amendment to the Workmen's Compensation Law was enacted, relating to silicosis and other dust diseases. This Act had been amended in 1920 to provide compensation for a list of twenty-seven diseases. Effective April 8, 1935, the Act was again amended, and item 28 was added to the list, as follows:

"Item 28. Any and all occupational diseases."

This amendment made the pneumoconioses compensable, and the insurance rates for those industries having dust hazards were immediately and substantially increased. Apprehensive of this burden of increased costs, many industries either shut down or migrated to other states, with resulting loss of employment. To remedy this condition, the law was again amended by the enactment of Chapter 887 of the Acts of 1936, effective June, 1936, making special provisions for the compensation of the pneumoconioses, among which are the following:

(1) Denial of compensation for partial disability.

(2) A monetary limitation of liability in the amount of $500 for the month in which the Act becomes effective, with progressive increases at the rate of $50 per month until a maximum of $3000 was reached.

This $3000 maximum would have been reached October 1, 1940, but the 1940 amendment increases the limitation of monetary liability to $5000 and continues the progressive increases of $50 per month beyond October 1, 1940, until a limitation of $5000 is reached in December, 1943.

Another important provision of the 1940 amendment is the requirement for the appointment by the industrial commissioner of three expert medical consultants in all cases involving claims for injuries from dust diseases. The findings and opinion of the majority of this committee shall constitute the findings and opinion of the committee, and the report of the committee constitutes *prima facie* evidence of fact as to the matters therein contained.

## III. Trends of Legislative Developments

Compensation for injuries from the pneumoconioses, particularly silicosis, has presented some of the most difficult problems in the administration of our occupational disease laws.

Much publicity has been given to silicosis in industry during the past several years. The National Silicosis Conference was sponsored by the Secretary of Labor during 1936, and, as a result of the studies of the various committees of that Conference, it was found that far less disabling silicosis was present in the United States than had been popularly believed. The primary purpose of the compensation acts is to award compensation for actual disability and to avoid the imposition of costs on industry for unjust and unwarranted claims. To carry out this purpose in the case of injuries from the pneumoconioses, many state laws contain special provisions dealing with (1) limitation of employer's

liability for injuries from such diseases, (*a*) denial of compensation for partial disability and (*b*) limitations of monetary liability, and (2) creation of medical boards to determine controverted medical questions.

### (1) Compensation for Partial Disability

Of the occupational disease compensation laws and amendments that were enacted in 1939 and 1940, the laws of Idaho, Maryland, Massachusetts, New York, Ohio, and Pennsylvania deny compensation for partial disability; the law of Arkansas awards compensation for partial disability, provided no compensation shall be payable for disability of less than $33^1/_3\%$ of the total.

The trend of recent legislation for silicosis compensation, therefore, is to deny compensation for partial disability. Such provisions are desirable in laws that award compensation for the pneumoconioses until some standard method of evaluating partial disability has been developed and accepted by the medical profession. The following statements[3] support such legislative provisions:

> A diagnosis of silicosis does not necessarily mean disability, and therefore a complete diagnosis should state whether a decreased capacity for work is evidenced, its cause, and an estimate of its degree.
>
> A complete diagnosis should furthermore state whether or not pulmonary infection is present, active or latent, and if possible the causative organism.
>
> Attention is called to the fact that a diagnosis of silicosis does not necessarily mean disability. Silicosis is a slowly developing disease. Slight subjective symptoms and roentgenological evidences of pulmonary changes may be present for many years prior to the development of any measurable decreased capacity for work. In reports of investigations made in the United States, seldom has silicosis without pulmonary infection been found to produce serious disability.

### (2) Limitations of Monetary Liability

In those industries where dusts are hazards, employees may have a history of exposure extending over a period of years, during which time they may have sustained injuries by the inhalation of dust. With the enactment of a compensation law, the employer's legal relationship to his employees changes, and he becomes an insurer of their health against the diseases so made compensable. To lighten the potential burden of compensation for injuries sustained before the time the act becomes effective, the laws of many states make some provision for the gradual assumption of this liability rather than impose the full cost of compensation on the employer at one time.

Of the states whose occupational disease compensation laws were enacted or amended during 1939 and 1940, Arkansas, Idaho, Maryland, Massachusetts, New York, Ohio, and Pennsylvania make special provision for the assumption by the employer of his "accrued" or "potential" liability. The plans adopted are not entirely uniform, but the method most generally followed is to limit the employer's liability to a figure of $500 during the first month the act becomes effective, with progressive increases at the rate of $50 per month until some maximum figure is reached.

Experience in the administration of occupational disease compensation laws following the passage of such a law has indicated that such provisions have avoided an immediate substantial increase in insurance rates and have lessened the incentive of employees to file claims for pre-existing injuries immediately on the effective date of the act. Such provisions have also served to avoid the discharge of employees previously exposed before the time the act becomes effective and have likewise avoided the use of waivers whereby such employees might waive or limit the full compensation to which they would be entitled under the proposed act.

### (3) Creation of Medical Boards

All of the laws and amendments to laws enacted at the 1939 and 1940 legislative sessions make specific provision for the creation of medical boards or medical consultants to assist the administrative agency in the determination of controverted medical questions. These boards are empowered to examine and re-examine the claimant, with the right to conduct or supervise autopsies in death cases when the board believes such procedure essential to determine the cause of death. The findings of such boards include (1) determination of the existence of the disease for which the claimant seeks compensation and (2) appraisal of disability arising therefrom.

Experience in the administration of occupational disease compensation laws has demonstrated that a medical board is the most competent agency to determine the medical issues involved in claims for compensation. Physicians appearing on behalf of the claimant and the employer will express irreconcilable opinions. These opinions are assumed to be thoroughly professional and to represent the honest and mature judgment of the witnesses. Unless provision is made, however, for the services of a medical board, there is a return to the vice existing under the old system of jury trials where each new case requires that the parties are charged with the necessity of providing expert medical testimony for the administrative agency. When medical boards are established, they function as the representative of the state, disinterested as a party to the proceedings and thus better able to determine these technical medical questions than any other agency to which such functions could be assigned. All of the recently enacted occupational disease compensation laws take cognizance of this fact and have provided for the creation of medical boards; where such boards have been previously created, their duties and powers have been increased.

## IV. Federal Legislation

On February 29, 1940, Senator Murray of Montana introduced Senate Bill No. 3461 in the United States Senate. At the time of its introduction, Senator Mur-

[3] "Report on Medical Control of the National Silicosis Conference," *Bull.*, No. 21, Part 1, issued by the United States Department of Labor.

ray prepared and submitted a statement which was incorporated into the *Congressional Record* and which is quoted in part as follows:

> The purpose of this bill is to aid the states in the control of occupational diseases, i.e., disabling conditions from exposures encountered in employment, by effecting better control of these hazards through maintaining special industrial-hygiene units in state labor departments, these industrial-hygiene divisions to function (1) by designing and applying engineering control measures to existing exposures, (2) by aiding in the preparation of suitable rules and regulations for prevention and by directly aiding the enforcement agency charged with the application of the rules and regulations, and (3) by aiding the state adjudicating agency in the disposition of workmen's compensation claims.
>
> If industrial-hygiene work is to serve a practical purpose other than the mere development of scientific information, it must be carried out by an agency integrated with the Department of Labor, which has full responsibility for and jurisdiction over protecting the health of workers.

The basic purpose of this Bill is to transfer to state labor departments complete control over industrial-hygiene work under the general supervision of the Secretary of Labor and to discontinue the activities of state health departments in this field.

The Bill authorizes an appropriation of $1,000,000 for the year ending June 30, 1941; $2,000,000 for the year ending June 30, 1942; $3,000,000 for the year ending June 30, 1943; and thereafter a sum sufficient to carry out the purposes of the Act.

It further provides that a state compensation plan may be approved by the Secretary of Labor only when such plan contains the following provisions:

(1) Financial participation by the state.

(2) Administration of the state plan by the state Department of Labor.

(3) Such methods of administration as are found by the Secretary of Labor to be necessary for the efficient operation of the plan.

(4) Compulsory reporting by employers of all cases of disability or death due to any disease.

(5) An industrial-hygiene agency adequately staffed and equipped to develop and appraise methods of controlling industrial conditions hazardous to the health of workers.

(6) A state agency administering plan must make reports in such form and containing such information as required by the Secretary of Labor.

The Secretary of Labor is authorized to appoint advisory committees composed of representatives of employers, employees, the public, and technical experts to advise with respect to (1) the operation of any such plan, (2) minimum standards for procedural safeguards and administrative facilities, and (3) such other matters as the Secretary of Labor may deem advisable.

The Bill also authorizes the Secretary of Labor, with the approval of the Secretary of the Treasury, to allot to the states the total amounts appropriated by the Act, such allotments to be determined on the basis of (1) population, (2) number of employed wage earners, (3) special industrial health problems, and (4) financial needs of respective states.

This Bill, if enacted, would grant to the federal Secretary of Labor the authority to reject any state occupational disease law which, in the opinion of the Secretary of Labor, is defective legislation. The Secretary of Labor would have the punitive power of withholding federal funds from the offending state, and the inevitable result would be the assumption by the federal authorities of jurisdiction over the administration of our occupational disease compensation acts.

There are only three states whose industrial-hygiene units have been established exclusively in the state Department of Labor, namely, New York, Massachusetts, and Illinois. In the other states, these departments have been established in the state Department of Health. The problem of prevention and control of occupational diseases is primarily a health problem and should be under the exclusive jurisdiction of state Departments of Health. The enactment of this proposed law would result in the creation of separate industrial-hygiene units in state Departments of Labor, duplicating available services in most of the states and transferring to state Departments of Labor this most important health problem.

The federal Department of Labor has justly emphasized the problem of occupational diseases in industry, and full credit should be given to that Department for its activities in advocating the prevention and control of these diseases. The United States Public Health Service and the individual state Departments of Health have been most effective, however, in their activities to stamp out these diseases, and, in view of the results already obtained, bureaus of industrial hygiene should remain in the state Departments of Health.

## V. Conclusion

There are already indications that important amendments to existing occupational disease compensation laws will be offered at the 1941 sessions of the various state legislatures. The purpose of some of these laws will be to increase the number of diseases that are compensable under the law or to increase the amount of compensation payable thereunder. Other amendments may be offered to remedy existing defects in the laws and to provide for more efficient administration.

There will also undoubtedly be an effort in the federal Congress to procure the enactment of a law to accomplish the purposes sought by the Murray Bill. Industry should concern itself with that effort on the part of the federal government to assume control and direction over the formulation and administration of our state compensation laws. This matter is of major importance and, unless intelligent, active opposition to this movement is initiated and maintained, it is probable that new powers will be granted to federal departments that will restrict and limit the activities of established state departments.

Methods of prevention and control of occupational diseases have been perfected by the various state departments. Bureaus of industrial hygiene have been

established in the majority of states, and these bureaus have initiated programs to study industrial conditions and to formulate rules, regulations, and methods to eliminate occupational disease hazards. Industry should welcome the assistance that these bureaus afford, because prevention of occupational diseases is of primary interest to employees and saves employers the cost of compensation.

MULLIKIN, STOCKBRIDGE, AND WATERS
BALTIMORE, MARYLAND

# HEALTH OF BRICK AND TILE PLANT WORKERS IN NORTH CAROLINA*

BY M. F. TRICE†

ABSTRACT

Data are reviewed which were obtained in an investigation of the North Carolina brick and tile industry to evaluate the siliceous dust exposure of the workers in terms of hazards to health. The distribution of the forty-eight plants is classified according to the raw material used, that is, alluvial clay or shale. The extent of the dust exposure of the workers by occupational classification is appraised in terms of millions of particles of dust per cu. ft. of air, based on particle-count analyses of 183 samples of air-borne dust collected in twenty-eight plants. An evaluation of the health status of the workers is based on medical data obtained in the clinical and X-ray examination of 1555 employees in plants, most of which were the same as those in which dust samples were obtained. The investigation disclosed that none of the employees had silicosis, a fact which apparently is explained by a low quartz content of the atmospheric dust, an absence of excessive concentrations of dust, and a high labor turnover.

## I. Introduction

A potential hazard to health exists whenever workmen are exposed to dust that contains quartz, flint, or other forms of uncombined silica, as such particulate matter is definitely toxic.[1(a)] The role of combined silica, or silicates as causes of pulmonary diseases, however, cannot be so categorically assessed. Authorities differ with respect to the toxicity of silicates although most of them no doubt would agree "that the presence of other inorganic dusts in the silica-containing atmosphere may tend to influence the rate of progressive reaction . . . (to) . . . inhaled silica."[1(b)] Although there is some question as to the effect of silicates in general, several of them, notably asbestos,[2] steatite (talc[3]), and mica[4] are capable of producing a serious and sometimes disabling pathology. Any silicate dust therefore should be regarded as a probable menace to health until such time as it can be proved innocuous in the concentrations that are encountered in routine.

Because the raw material from which brick and tile are made is siliceous in character, an investigation of the North Carolina industry has been made to evaluate the dust exposure of the workers in terms of hazards to health, particularly with respect to silicosis. Most of the medical and engineering data were collected over a twelve-month period, beginning in the summer of 1938.

## II. Evaluation of Working Environment

In a study of this character, it is desirable to appraise, in terms of an average dust concentration, the exposure of the workers in each occupational classification, as such values permit a comparison of occupations with respect to the extent of the dust hazard and are useful in correlating medical and engineering data. The Greenburg-Smith impinger[5] was used to the collect 183 samples of atmospheric dust for particle counts in twenty-eight plants. These dust samples were collected during each of the four seasons under a variety of weather conditions and so distributed as to yield a

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† Industrial Hygienist, Div. of Industrial Hygiene, N. C. State Board of Health and N. C. Industrial Commission, Raleigh, N. C.

[1] (*a*) R. R. Sayers and R. R. Jones, "Silicosis and Similar Dust Diseases," *U. S. Pub. Health Repts.*, **53** [33] 1453–72 (1938); p. 1456; *Ceram. Abs.*, **18** [1] 40 (1939).

(*b*) L. U. Gardner, "Inhaled Silica and Its Effect on Normal and Tuberculous Lungs," *Jour. Amer. Med. Assn.*, **103** [9] 743–48 (1934).

[2] W. C. Dreesen, J. M. Dalla Valle, T. I. Edwards, J. W. Miller, R. R. Sayers, H. F. Easom, and M. F. Trice, "Study of Asbestosis in the Asbestos Textile Industry," *U. S. Pub. Health Bull.*, No. 241 (Washington, D. C., 1938).

[3] W. C. Dreesen and J. M. Dalla Valle, "Effects of Exposure to Dust in Two Georgia Talc Mills and Mines," *U. S. Public Health Repts.*, **50**, 131–43 (1935); Reprint No. 1669.

[4] W. C. Dreesen, J. M. Dalla Valle, T. I. Edwards, R. R. Sayers, H. F. Easom, and M. F. Trice, "Pneumoconiosis Among Mica and Pegmatite Workers," *U. S. Pub. Health Bull.*, No. 250 (Washington, D. C., 1940).

[5] Leonard Greenburg and J. J. Bloomfield, "Impinger Dust Sampling Apparatus as Used by U. S. Public Health Service," *U. S. Pub. Health Repts.*, **47**, 654–75 (1932); Reprint No. 1528.

representative evaluation of the atmospheric dust conditions in the industry. The importance of an occupation, insofar as it concerns the distribution of dust samples, was based on the number of men involved and the apparent dustiness of the job. A proportionately greater number of samples was thus collected to evaluate the exposure of a screen attendant than that of a hacker because the screen attendants in most plants are exposed to much more dust than the hackers.

### (1) Dust Exposure by Occupational Classification

Inasmuch as the manufacture of brick at some plants is performed under virtually outdoor conditions, all dust counts were classified according to the type of building in which they were collected, that is, "closed" or "open." Average values were computed, after this segregation, for each occupation for both types of buildings. Whenever the two results obtained checked closely, they were combined, and the one value was employed for the occupation in both types of plants. One dust-exposure value thus serves for all hackers. The dust counts for open- and closed-type plants were further classified according to raw material employed. As the values obtained for both the clay and the shale plants were almost identical, the results were discarded. The calculated average dust exposures of the workers by occupational classification (expressed in millions of particles of dust per cu. ft. of air) are shown in Table I.

### (2) Character of Dust

Because free silica or quartz is a toxic mineral insofar as pulmonary pathology is concerned, it is desirable to know the amount contained in the atmospheric dust to which the workmen are exposed. Samples for petrographic analysis accordingly were obtained directly from the atmosphere with an electrically driven, hand vacuum cleaner suspended at the breathing level and operated intermittently for a period of several days. Inasmuch as only one such sampling device was available (and it was out of commission for a while), several samples of settled dust were collected from structural members. Four samples of atmospheric dust and three samples of settled dust were examined petrographically for quartz content, the results of which are presented in Table II. No two of these samples were collected in the same plant. Although both of the clay samples contain more quartz than the shale samples, they represent settled dust, which may account for their higher quartz content. An analysis of samples by particle-size fractions is frequently made to determine the quartz content of the respirable sizes. The brick plant dusts, however, were not so meticulously analyzed. West

TABLE I

AVERAGE DUST EXPOSURE OF WORKERS BY OCCUPATIONAL CLASSIFICATION

| | No. samples considered | Dust exposures (millions/cu. ft.) Max. | Min. | Avg. |
|---|---|---|---|---|
| Hoistman (inclosed and preparation machinery) | 11 | 26.0 | 9.4 | 19.0 |
| " (open " " " ) | 10 | 6.0 | 1.0 | 3.0 |
| Clay storage bin | 4 | 5.0 | 1.0 | 3.0 |
| " " " (inclosed) | 1 | | | 71.0 |
| Crusher (rolls and disintegrator attendant, root boy) | | | | |
| Inclosed (no bats) | 4 | 45.0 | 3.0 | 21. |
| " (bats) | * | 227.0 | | 33.0 |
| Open (no bats) | 5 | 14.0 | 2.0 | 7.0 |
| " (bats) | * | 227.0 | | 19.0 |
| Screen attendant, inclosed | 11 | 166.0 | 14.0 | 69.0 |
| " " inclosed, full bin | 2 | 6.0 | 2.0 | 4.0 |
| " " open | 2 | 2.0 | 2.0 | 2.0 |
| Dry pan operator, closed (material dry) | 3* | 162.0 | 3.0 | 44.0 |
| " " " " ( " damp) | 3* | 22.0 | 3.0 | 8.0 |
| " " " salvage | 2* | 816.0 | 11.0 | 112.0 |
| " " " open | 2 | 11.0 | 8.0 | 10.0 |
| Pug-mill operator | | | | |
| Preparation-machinery exposure | 10 | 88.0 | 21.0 | 51.0 |
| Isolated from preparation machinery | 5 | 18.0 | 9.0 | 10.0 |
| Brick machine | 3 | 10.0 | 7.0 | 9.0 |
| Open mill discharge | 2 | 184.0 | 89.0 | 137.0 |
| Hackers | 25 | 52.0 | 1.0 | 13.0 |
| Transfer, upper | 3 | 16.0 | 16.0 | 16.0 |
| " lower | 3 | 8.0 | 1.0 | 4.0 |
| " " (car rackers) | 2 | 6.0 | 4.0 | 3.0 |
| Kiln workers, downdraft | 41 | 57.0 | 4.0 | 17.0 |
| " " updraft | 5 | 17.0 | 9.0 | 12.0 |
| Kiln cleaning | 5 | 274.0† | 69.0 | 138.0 |
| Pipe manufacturing, pipe feeder (isolated) | 1 | | | 14.0 |
| " " pressman | 3 | 39.0 | 5.0 | 25.0 |
| " " special shapes | 1 | | | 5.0 |
| Pipe drying floor | 4 | 92.0 | 8.0 | 33.0 |
| Cleanup man | 4 | 51.0 | 13.0 | 28.0 |

* Weighed average. † Cleaning kiln eyes.

NOTE: "Inclosed and preparation machinery" means a closed type of building in which workers are exposed to dust created by this machinery. Dried or fired bats when ground produce much dust; "no bats" and "bats" indicate, respectively, the absence or involvement of such material.

Virginia authorities[6] report that the finer fractions of air-borne dust in brick and tile plants contain less quartz than the raw materials from which the dust originates. They estimate that the quartz content of air-borne dusts varies from 3 to 10%.

TABLE II

QUARTZ CONTENT OF SAMPLES OF ATMOSPHERIC AND SETTLED DUST OBTAINED IN N. C. BRICK AND TILE PLANTS

| Identification | Quartz content (%) |
|---|---|
| Settled dust (clay) | 25 |
| Atmospheric dust (shale) | 10 |
| " " " | 10 |
| " " " | 15 |
| " " " | 15 |
| Settled dust (clay and shale) | 13 |
| " " (clay) | 20 |

Greaves-Walker and his co-workers[7] report that quartz is abundant in all samples of clay and shale deposits of North Carolina.

## III. Cumulative Dust Exposure of Workers

In an evaluation of an occupational disease hazard, the medical data are usually correlated with the total dust exposure of the workers as well as with their total lengths of service. As the amount of dust to which the men are exposed varies with the occupation, the total dust exposures of the workmen are of more value than their lengths of service in years. Some jobs expose the men to little dust; others to appreciable amounts of dust, as shown in Table I. To compare workmen on the basis of their total dust exposure, a million-particle year dust index[8] is used which is obtained by multiplying the average yearly dust exposure of an occupation by the total number of years spent therein. A man exposed to an average of ten million particles of dust per cu. ft. of air in ten years would therefore build up a cumulative exposure of 100 million particle years of dust. When more than one occupation is involved, the cumulative exposure for each is calculated and a total exposure computed by adding together the individual occupational exposures.

A distribution of the workers according to arbitrarily selected cumulative dust-exposure classifications is presented in Table III.

Virtually 80% of the routine workers have accumulated less than 150 million particle years of dust, which is not an excessive exposure. This conclusion may be examined on the basis of the free silica (or quartz) content of the dust. It is generally accepted that five million particles of quartz (of respirable size) per cu. ft. of air is the maximum concentration that may be tolerated with safety. The brick plant workers are exposed to dusts, the quartz (or free silica) content of which varies from 10 to 25% (Table II). If the maximum concentration of 25% of free silica is employed for illustration, then a concentration of twenty million particles of such dust per cu. ft. of air would contain five million particles of quartz, which is the maximum amount that may be tolerated with safety. Assuming that forty years constitute a normal lifetime, a person could theoretically build up a cumulative exposure of 800 million particle years of such dust without incurring a serious risk to health. Thus 800 million particle years become a kind of yardstick by which the cumulative dust exposures of the workers may be gauged. Only twenty routine workers (see Table III) have built up a cumulative exposure of more than 500 million particle years of dust, which is only a little more than one half of the 800 million-particle-year yardstick at which some evidence of dust pathology might be expected. This hypothetical "threshold" limit is based on the dust sample with the maximum quartz content, which is undoubtedly much higher than that of the average atmospheric dusts to which the workers are exposed. Thus, instead of the total "threshold" dust exposure being 800 million particle years of dust, it is probably at least double that figure, as the quartz content of the air-borne dust samples (Table II) averages only 12.5%, or one half of the figure used. One worker only has built up a cumulative exposure of more than 1600 million particle years. The length of exposure, in years, of the employees reveals that almost one half of the routine workers examined have been in the industry more than ten years. After so long a period of service, however, their cumulative dust exposures are only a fraction of the theoretical "threshold" computed as a yardstick by which to examine the total dust exposure of the workmen. These assumptions and computations, therefore, indicate that the siliceous dust hazard is not acute in the North Carolina brick and tile industry.

## IV. Medical Examinations

Medical examinations, including an X-ray film of the chest, were given to 1555 employees and prospective employees in twenty-eight plants, which were not identical in every instance with those in which dust samples were collected. The clinical and X-ray examinations were made on the premises of the respective companies in the cruising X-ray trailer of the North Carolina Division of Industrial Hygiene.[9] The medical examination given to the workers was thorough, especial emphasis being placed on the heart and lungs. Blood specimens for the Wassermann and Kline tests for syphilis were obtained from a large number of the persons examined. A complete medical and occupational history was also obtained in every instance.[10]

[6] "Preliminary Report of Study in Brick and Tile Industry in W. Va.," Bureau of Industrial Hygiene, W. Va. State Health Dept., Charleston, W. Va., 1939.

[7] A. F. Greaves-Walker, N. H. Stolte, and W. L. Fabianic, "Occurrence, Properties, and Uses of Commercial Clays and Shales of N. C.," *N. C. State Coll. Agr. & Eng. Expt. Sta. Bull.*, No. 6, 74 pp. (1934); *Ceram. Abs.*, **15** [3] 105 (1936).

[8] J. M. Dalla Valle, "Significance of Dust Counts," *U. S. Pub. Health Repts.*, **54**, 1095–1104 (1939); Reprint No. 2083.

[9] C. R. Matheson and M. F. Trice, "North Carolina's Mobile X-Ray Laboratory," *Jour. Ind. Med.*, **7**, 327–30 (1938).

[10] M. F. Trice, "Pre-Employment Examinations and Related Activities of N. C. Div. of Industrial Hygiene," *ibid.*, 9, 188–93 (April, 1940); *Ceram. Abs.*, **19** [11] 272 (1940).

TABLE III

DISTRIBUTION OF WORKMEN BY ARBITRARY TOTAL DUST-EXPOSURE CLASSIFICATIONS

| Total exposure (m.p.y.)* | Total employees | Pre-employment (No.) | Pre-employment (%) | Routine (No.) | Routine (%) | Rejected (No.) |
|---|---|---|---|---|---|---|
| Negative | 374 | 301 | 60.7 | 71 | 6.7 | 2 |
| Less than 25 | 356 | 166 | 33.5 | 189 | 17.9 | 1 |
| 25– 50 | 236 | 23 | 4.6 | 213 | 20.2 | |
| 50–100 | 229 | 5 | 1.0 | 224 | 21.3 | |
| 100–150 | 140 | | | 140 | 13.3 | |
| 150–200 | 85 | | | 83 | 7.9 | 2 |
| 200–300 | 79 | | | 77 | 7.3 | 2 |
| 300–400 | 22 | | | 21 | 2.1 | 1 |
| 400–500 | 13 | | | 13 | 1.3 | |
| 500 and over | 21 | 1 | 0.2 | 20 | 2.0 | |
| TOTAL | 1555 | 496 | 100.0 | 1051 | 100.0 | 8 |

* Million particle years.

TABLE IV

PERCENTAGE OF BRICK AND TILE WORKERS EXAMINED HAVING TUBERCULOSIS CONTACTS, PAST RESPIRATORY ILLNESSES, AND OTHER MEDICAL FINDINGS IN EACH GROUP SPECIFIED

| Past medical finding | Men examined (%): Pre-employment | Men examined (%): Routine |
|---|---|---|
| Family history of tuberculosis | 1.6 | 1.9 |
| Exposure to tuberculosis | 1.2 | 1.1 |
| Pleurisy | 2.8 | 4.3 |
| Hemoptysis (blood-streaked sputum) | 1.4 | 0.9 |
| Pneumonia | 8.3 | 9.2 |
| Influenza | 20.8 | 15.8 |
| Colds (few reported) | 87.5 | 80.0 |
| Colds (more in recent years) | 2.6 | 3.1 |
| Other respiratory diseases | 29.4 | 27.0 |
| Clubbed or bowed extremities | 8.9 | 12.0 |
| Diaphragm (normal) | 92.0 | 89.0 |
| Diaphragm (angles shallow) | 4.4 | 5.2 |
| Childhood tuberculosis | 6.7 | 7.5 |
| Childhood and adult tuberculosis | 0.2 | 0.2 |
| Pulmonary tuberculosis (activity (?) or arrested) | 1.0 | 1.0 |

The examination of the workers in brick and tile plants was expected to reveal the existence of pulmonary pathology that could be attributed to the inhalation of dust. When the complete absence of such pathology was reported, it was decided to analyze all of the medical data carefully to determine whether some effect of dust inhalation might be revealed by higher incidences of the more commonplace respiratory disorders. All data therefore were coded on punch cards and analyzed on International Business Machines tabulating equipment. The more important results of this analysis, except the heart findings, are presented in Table IV. There is no appreciable difference in the incidence of the various findings for the pre-employment and routine workers, indicating that exposure to brick-plant dust has produced no demonstrable effect on the health of the workers. Inasmuch as all pre-employment and routine workers alike are from the same economic level, the former serve as a satisfactory control group with which to compare the latter. The group of men examined were in an unusually excellent state of health, except eight men who were rejected for employment, one of whom had tuberculosis questionable, four questionably active, and three definitely active tuberculosis. Seven of the persons rejected were routine workers; the other was a pre-employment case.

TABLE V

NUMBER AND PERCENTAGE OF PRE-EMPLOYMENT AND ROUTINE WORKERS, CLASSIFIED BY RACE, REACTING POSITIVELY TO WASSERMANN AND KLINE TESTS FOR SYPHILIS

| | Pre-employment: White (No.) | Pre-employment: White (%) | Pre-employment: Colored (No.) | Pre-employment: Colored (%) | Routine: White (No.) | Routine: White (%) | Routine: Colored (No.) | Routine: Colored (%) |
|---|---|---|---|---|---|---|---|---|
| Wassermann | | | | | | | | |
| Negative | 62 | 94.0 | 69 | 52.2 | 53 | 93.0 | 161 | 43.6 |
| Doubtful | 1 | 1.5 | 11 | 8.4 | 1 | 1.8 | 31 | 8.4 |
| Positive | 3 | 4.5 | 52 | 39.4 | 3 | 5.2 | 177 | 48.0 |
| Not done | 115* | | 182* | | 227* | | 398* | |
| TOTAL | 181 | | 314 | | 284 | | 767 | |
| Kline | | | | | | | | |
| Negative | 94 | 91.3 | 157 | 71.0 | 221 | 93.5 | 382 | 58.5 |
| Doubtful | 6 | 5.8 | 15 | 6.7 | 8 | 3.5 | 72 | 11.0 |
| Positive | 3 | 2.9 | 49 | 22.3 | 7 | 3.0 | 200 | 30.5 |
| Not done | 78* | | 93* | | 48* | | 113* | |
| TOTAL | 181 | | 314 | | 284 | | 767 | |

* Not considered in calculating percentages.

## V. Medical Findings

The X-ray films of the 1555 workers were read separately and apart by two physicians, both of whom reported that there was no evidence in any of them of silicosis or any other pulmonary condition that could be attributed to dust.

### VI. Venereal Disease

In view of the nation-wide campaign to eradicate venereal diseases, the medical findings relating to this scourge are presented in Table V. The incidence of syphilis is much higher among the colored workers. Among those whose blood was subjected to the Wassermann test, 48% of the routine colored workers reacted positively as against 5.2% of the routine white workers. Results of reactions to the Kline test were 30.5% against 3.0%; about the same ratio holds for the pre-employment cases.

### VII. Conclusions

The total absence of silicosis and other serious pulmonary pathology and the low incidence of other respiratory diseases among 1555 brick and tile plant workers indicate that exposure to dust in the North Carolina industry does not constitute a serious menace to health.

Division of Industrial Hygiene
North Carolina State Board of Health
Raleigh, North Carolina

# CERAMIC HISTORY

## WALTER JODOK KOHLER*

Let me die, working,
Still tackling plans unfinished, tasks undone!
Clear to its end, swift may my race be run.
No laggard steps, no faltering, no shirking;
Let me die, working.

Walter J. Kohler, Chairman of the Board of Directors of Kohler Company, spent a busy day at his office, Saturday, April 20, 1940, working until near seven o'clock in the evening with the vigor and zest which always characterized him. Much of the morning was given to correspondence, study of operating reports, and presiding toward noon at a meeting of the executive committee. Afternoon brought a long conference with company engineers regarding a projected new factory building and its equipment.

On Sunday, the members of the organization, the people of the village, and thousands of friends were inexpressibly shocked to learn that he had been stricken that morning with a fatal attack of coronary embolism.

The verses above, by S. Hall Young, dated 1933, which he clipped and saved, had been prophetic.

### Boyhood and Early Responsibilities

Walter Jodok Kohler was born March 3, 1875, in Sheboygan, Wisconsin, the son of John Michael and Lillie Vollrath Kohler. His mother died on March 2, 1883, the day before his eighth birthday. On November 3, 1887, his father married Minnie Vollrath, his mother's sister. Walter was devoted to her through the years, and her photograph was on his office desk at the time of his passing.

He was the third of a family of four sons and three daughters.

Family ties and traditions were ever a dominating interest and influence in his life, and his middle name Jodok, long in the Kohler family, is reminiscent of the Bregenzerwald (Forest of Bregenz), near Lake Constance in Austria, where the Kohlers had dwelt, according to church records, since 1624.

Thence John Michael Kohler came as a boy of ten with his father and the immediate family to America, where they settled on a farm near St. Paul, Minnesota. Reaching manhood, he worked for a time in Chicago. After the great fire, he went to Sheboygan, Wisconsin, where he married. There, in 1873, he established a manufacturing business which the family has continued ever since.

Walter Kohler was baptized into the Episcopal church, with which he continued affiliation throughout his life. He also belonged to the Blue Lodge of the Masonic Order.

His formal education was obtained in the Sheboygan public schools. At fifteen, he decided that he wanted to go into his father's business. He followed a natural urge. In the factory, he put in long hours at man's labor before the enameling furnaces and in the foundry, receiving a wage of about $1.25 a day. He became a foreman at eighteen and factory superintendent at twenty-five.

In 1899, the factory was removed by his father, John Michael Kohler, to its present site, which was then in the open country.

The death of his father, one month after its removal and two days after Walter's wedding day in the fall of 1900, left three young brothers, Robert, Walter, and Carl, to cope with difficulties which, a few months later, became more formidable with the total destruction of the new plant by fire.

They returned to the old plant in Sheboygan and continued business. Triumphing over the problems of financing, planning, construction, and equipment, they rebuilt the plant, reopening it one year later on the anniversary of the fire.

By the untimely passing of the two brothers who had been associated with him, Walter Kohler was left in 1905 the responsible head of the business. A series of calamitous events had precipitated him, at the early age of thirty, into the presidency of the company, a position which he held until 1937 when, becoming Chairman of the Board, he was succeeded as President by his youngest brother, Herbert V. Kohler.

Among Mr. Kohler's many civic activities, his keenest

* From *Kohler News*, **24** [5] (May, 1940).

interest centered in Kohler Village, in whose development as a self-governing, town-planned, garden community he was the recognized moving spirit.

In 1928, after a successful campaign for delegate-at-large from Wisconsin to the Republican national convention, Mr. Kohler consented to stand for the governership, was nominated over two rivals in the primary election in September, and was elected by the largest vote that had ever been cast for any candidate for that office.

Mr. Kohler was married November 3, 1900, to Miss Charlotte Henrietta Schroeder, of Kenosha, who had been a teacher of art in the Sheboygan schools. He is survived by her and by their four sons, John Michael, Walter Jodok, Jr., Carl James, and Robert Eugene Kohler; by his sisters, the Misses Evangeline, Marie Christine, and Lillie Babette; by his brother, Herbert Vollrath Kohler; and by nine grandchildren.

Among Mr. Kohler's many responsibilities and affiliations in recent years, he was Chairman of the Board of Kohler Company, Ltd., London, England; and of The Vollrath Company and the Security National Bank of Sheboygan. He was President of Mountain States Supply Company, Salt Lake City, Utah; a Director of the Chicago North Western Railway system; and a Trustee of the Northwestern Mutual Life Insurance Co.

He was Vice-Chairman of the National Industrial Conference Board; Vice-President and Director of the National Association of Manufacturers; Director of the Wisconsin Manufacturers Association; Director of the Planning Foundation of America; member of the Wisconsin State Historical Society; honorary member of the Wisconsin Horticultural Society; Trustee of Lawrence College, Appleton, Wisconsin; President of Friendship House, Sheboygan, a transient child-caring institution founded by his father; and Trustee, Wisconsin Alumni Research Foundation.

Mr. Kohler had held a Corporation Membership in The American Ceramic Society since 1923.

He achieved renown and influence, not only in Wisconsin, but throughout the nation, as a clear-sighted, effective industrial leader, actuated by high motives. Mr. Kohler always worked mightily. Prominently displayed in his private office was a likeness of John Ruskin, with the legend,

> Life without labor is guilt—
> Labor without art is brutality.

Thoroughness was almost a religion with Mr. Kohler. He had that "great aptitude for patience," for "taking pains," which is genius itself.

### Management and Production Methods

Mr. Kohler had an understanding of techniques, methods, equipment, and the whole physical side of the branches of industry in which he engaged, as well as a wide knowledge of applied science and the world's work in general.

Complementing this was his rare faculty of understanding people, entering into their problems, and joining hands with them in work and comradeship.

Coming up from boyhood to maturity in the manufacturing division, Mr. Kohler had a personal pride in the efficiency of operations and a keen interest in the quality of product.

Facilities and ways of work were steadily improved under his guidance as a result of day-by-day experience, laboratory research, and field trips extending even to foreign countries. Conveyer systems, molding machinery, furnace construction, enameling methods, fuels, crating, and all aspects of production were subjects of constant study.

In the two most recent decades, several new major divisions were added for the manufacture of electric plants, vitreous china plumbing fixtures, brass fittings, heating boilers, radiators, and other products.

Among pioneering originations in plumbing fixtures, it is doubtful if any has surpassed in importance the one-piece built-in bath with apron, which, more than any other single facility, won favorable public attention and prompted an interest and pride in adequate plumbing. This was Mr. Kohler's invention of thirty years ago, one of the many advances the industry owes to him.

His insistence always upon quality created in the public mind a high reputation for Kohler products and in the organization an intense pride of achievement and doing things well.

It has often been recounted how, in the nineties, Mr. Kohler, as a young factory superintendent, reduced the hours of work on continuous furnaces from twelve to eight, further reductions following in later years there and in other departments. He had done such work himself and knew what was a fair and tolerable daily task. He believed in good wages and maintained a scale equal to or higher than any in the industry and much higher than the ruling rates in surrounding communities or the average in the State of Wisconsin.

In the depression period, although building started to fall off in 1928, the entire organization worked full time, at full wages, until well into 1931, by which time inventories had become huge. As the depression became deeper and more protracted, with residential building throughout the nation reduced by more than 90%, work in the plant was spread, causing shortened hours and reduced earnings. In the latter half of 1933, it became necessary to close certain entire units, including some pottery kilns. This compelled some lay-offs, comparatively few in number but doubly distressing to Mr. Kohler because his ideal and practice had always been to keep everybody in the organization employed.

Distressed by economic conditions which were nation wide and virtually world wide, a number of employees were induced by promises and political influences to join in a newly formed union to demand sole bargaining rights for the entire production personnel, the majority of whom had strong objections to being represented by that organization. The village residents almost to a man took that view and were strongly opposed to the strike and its disorders which followed.

A majority of the pickets were persons who never had been in the company employ, and many were strangers from distant places. The strike was called in July, 1934, and culminated twelve days later in a destructive riot. Daily Mr. Kohler entered the plant through menacing

picket lines, fearlessly exercising his right of an American citizen.

In a government-supervised election held a few weeks later, an independent organization, the Kohler Workers' Association, won by a large majority, and after extensive hearings and argument the K.W.A. was certified by the National Labor Board as the exclusive bargaining agency.

It is well known how Mr. Kohler caused workmen's compensation to be adopted for the plant long before there was a Wisconsin compensation law in force, anticipating many provisions of the State Act afterward passed; and thus, men, if they met with accident, could get a fair financial settlement without lawsuit, although most of the claims would not have been collectible by actions at law. He always held that the risks of industry should be guarded against by employers as thoroughly as possible; and, if an accident occurred, the whole burden of it should not fall on the shoulders of one unfortunate man or one family.

### National Service Fellowship Medal

When Mr. Kohler was awarded the National Service Fellowship Medal of the Society of Arts and Sciences in 1934, the citation stated, "You have demonstrated that an article of manufacture can be produced economically, profitably, and efficiently in an environment of beauty and that there is no necessity for ugliness in connection with a manufacturing town or slum environment for the workers in its factories."

Declining to regard the honor as for himself alone, Mr. Kohler said in his response, "I am pleased to accept this medal in behalf of those who participated in the planning and development of Kohler Village and particularly in behalf of the men and women who live in the community, whose interest and whole-hearted support constitute the public spirit which gives assurance of the wholesome and constructive village progress of the future."

Thus did he pass over his own part in a project to which he had devoted years and which had his interest in a greater degree than almost any other activity of his life.

Mr. Kohler once remarked that had he gone into a profession instead of business life, he thought he would have chosen architecture. The individuality and charm which characterize the homes in the village owe much not only to the work of good architects but to his own never-failing interest in careful planning and sound construction.

The company properties, appropriate to their practical purposes, have been made interesting and dignified in appearance and have abundant trees, with here and there stretches of lawn, flowers, shrubbery, and mellow, vine-covered walls.

In order, however, that the industrial plant might not dominate the homes or obtrude itself upon the domestic life, it is restricted to its own zone, separated from the residential by wide boulevards planted with screening trees.

A residential club for single men was built; and because part of its purpose was to offer wholesome American standards of life at moderate cost, as a substitute for the sometimes undesirable boarding houses, it was named the American Club. With rooms for about three hundred men, in addition to dining, recreation, and other extensive facilities, it occupies a large, beautiful building of brick and steep slate roof, set in broad lawns with stately trees, an ornament as well as a useful institution in the village.

Mr. and Mrs. Kohler, nearly twenty years ago, built their own home in the village and came to live among the workers—a delightful house set amid trees and gardens, filled with the evidences of their fine interests and tastes, a true home where Mr. Kohler's fellow-workers and members of their families were often invited.

He was an enthusiastic attendant at community gatherings. His interest in the school, the band, the fire department, and every branch of the social and civic life was deep and unfailing. Everybody in Kohler knew the genuineness of it, and the helpfulness.

The village did not belong to him. He belonged to the village. He always will.

### Public Offices and Governorship

Walter J. Kohler held but one elective public office, that of the Governor of Wisconsin. He did, however, have some earlier contacts with public affairs. He was chosen a Republican presidential elector in 1916 and a delegate-at-large to the Republican national convention in 1928.

He served on the Sheboygan Board of Park Commissioners by appointment made in 1915. During his presidency of the Board, the city park area was increased almost 300% by the purchase of Evergreen Park and the gift of Vollrath Park, a delightful lakeshore area, by the Kohler family and Vollrath heirs. Mr. Kohler was a member of the Park Board in Kohler Village from 1926, the only public office he ever held in that community.

He was a Regent of the University of Wisconsin for six years by appointment of Governor Emanuel L. Philipp and for three years was president of the Board. He took part in the election of Dr. E. A. Birge as university president.

John Callahan, State Superintendent of Public Instruction, had this to say of Mr. Kohler's regentship:

".....During the first years that I was state superintendent, I served on the Board of University Regents with him. During three years of that time he was president of the Board. In spite of the fact that he was a very busy man, I do not remember that he ever missed a meeting. He was a careful student of the University interests, and spent many days outside of Board meetings becoming familiar with its various problems. During his term as Governor, he was keenly interested in educational problems. Through his influence, the Interim Committee was set up to make a study of the school setup in the State. Many of the superintendents of other states have told me that they regarded the report made by this committee the best that had been made in any state for many years. We are slowly getting some results in the way of legislation from the recommendations in that report....."

Porter Butts, Secretary of the Memorial Union Building Committee of the University of Wisconsin, recently said, "As I have met with students over the past fifteen years, each group has learned the story of Mr. Kohler's vision and energy which brought the Union into being, so there are hundreds of students besides those of us on

the Building Committee who cherish and remember Mr. Kohler's contribution to a better student life on the campus. As much as to any one man, we consider the Union a monument to him." Mr. Kohler was highly gratified at the realization of the project as a center of cultural life.

He was chairman of the numerous war-time activities in Sheboygan County, with the exception of the first Liberty Loan, and each campaign under his leadership was carried to a highly successful conclusion.

Mr. Kohler was indorsed by the Republican convention at Green Bay in 1928 as its candidate for the governorship. In a three-way campaign, he won the nomination in the primaries over the incumbent then in office and the candidate for the "Progressive" faction. He was successful in the general election by a huge majority.

When he became Governor, it was officially estimated that the accrued deficit (excess of appropriations over income) at the beginning of his first fiscal year would be more than three and one-half million dollars. In one and one-half years, the condition was so changed that there was a surplus of over a million dollars on an accrual basis. At the end of his term, there were more than twenty million dollars of cash on hand.

He recommended and secured passage of measures, setting up a modern budget procedure; creating a single annuity and investment board in place of the seven boards which had previously handled State trust funds, including the Teachers' Retirement Fund; organizing the bureau of personnel; establishing a central bureau of purchases; consolidating three departments dealing with farm problems into a single department of agriculture and markets; and creating a full-time highway commission. This, notwithstanding the lack of party majority in the legislature.

Thus, a substantial and lasting reorganization of the State government was effected and greater efficiency was attained.

Some twenty statutes of interest to working men and women were passed, including a strengthening of the workmen's compensation law.

Mr. Kohler was especially interested and instrumental in the enactment of the Children's Code protecting the well-being of neglected, dependent, and delinquent children.

Such were a few of the measures enacted with his support.

At the outset of the depression, Wisconsin's State finances were in the best condition they had been in years. Governor Kohler, in order to provide employment, authorized the expenditure of all money that had been appropriated by the legislature for buildings or equipment. He appointed a committee, representative of labor, industry, and many other groups, to work toward a solution of the employment problem, with subcommittees going into questions of employment offices and statistics, public and private construction, regularization of employment, and unemployment relief, including the effects of shorter working hours, unemployment insurance, and emergency relief.

In 1930, Governor Kohler was subjected to a long legal trial on charges brought by political opponents to the effect that persons making certain campaign expenditures in 1928 were agents of his and that their expenditures brought his total above the amount permitted by law. It was a subject of comment that those who made the charges were conspicuously absent from the scene of the trial.

Who will ever forget that trial—in the courthouse of Sheboygan under whose shadow he had grown to manhood? The days upon days when he had to leave his official duties in Madison to answer trivial and unjust charges? Who will forget the last day when the jury, made up of fellow county citizens, reported to the judge the decision—not the foreman alone but in chorus they answered, "We are unanimous!" The courtroom was filled with townspeople, weeping and clasping the Governor's hand.

On appeal, the Supreme Court sustained the rulings and judgment of the presiding judge, Gustav G. Gehrz, of Milwaukee. The whole State was exonerated by that decision.

While the depression was world wide, it influenced Wisconsin politics and inspired reckless promises of the politicians to solve, within a single state, the problem of unemployment, agricultural relief, and nearly everything else; and in 1930, an opposing candidate received the indorsement. By 1933, the State had a deficit of over eleven million dollars, unemployment meanwhile having quadrupled; and by 1939 the net cash deficit, according to trustworthy figures, exceeded thirty-five million dollars.

Mr. Kohler again responded to the call of the voluntary state convention of Republicans in 1932. Making a vigorous campaign, he won an emphatic victory in the primary with a plurality of nearly 95,000. In the November election, he ran about two hundred thousand votes ahead of the Republican national ticket in Wisconsin; but it was not enough.

Mr. Kohler took no further part in politics as a candidate, though he was urged again and again to do so. He devoted his time and energies to business problems, which the depression accentuated greatly, to arranging the fullest practicable employment for the organization, to the village, and to his other interests and obligations, many of them of a civic nature.

# ACTIVITIES OF THE SOCIETY

## PITTSBURGH SECTION

**Winter Meetings**

A meeting of the Pittsburgh Section was held on January 14 at Mellon Institute. E. E. Marbaker of Mellon Institute, who was introduced by F. C. Flint, Hazel-Atlas Glass Co., Washington, Pa., spoke on "Development of Porcelain Enamel on Sheet Steel." The various types of enameling and the effect of the individual components of the enamels were discussed as well as recent structural applications of enameled sheets. Movies and stills of every phase of the industry from the compounding of enamels to buildings, jewelry, and stoves were shown.

At the meeting held on February 11 at Mellon Institute, Samuel Stevenson, Harshaw Chemical Co., Cleveland, Ohio, spoke on "Ceramic Colors and Stains in the Whiteware Industry." Developments in new colors and better control of present colors were discussed.

**Officers for 1941–1942**

*Chairman:* C. L. THOMPSON, Harbison-Walker Refractories Co., Pittsburgh, Pa.
*Vice-Chairman:* GEORGE J. BAIR, Mellon Institute, Pittsburgh, Pa.
*Secretary:* LOUIS A. SMITH, Jones & Laughlin Steel Corp., Aliquippa, Pa.
*Treasurer:* E. E. MARBAKER, Mellon Institute, Pittsburgh, Pa.

—LOUIS A. SMITH, *Secretary*

## CHICAGO SECTION

The Chicago Section held a meeting at the Electric Club in Chicago, Ill., on February 7, 1941. After dinner, the following papers were presented:

(1) "Profit Engineering as Related to Business Management" by C. R. FILIPPI, Illinois Brick Co., Chicago, Ill. (illustrated).

(2) "Electrolytes Used in Ceramic Bodies" by C. G. HARMAN, Dept. of Ceramic Engineering, Univ. of Illinois, Urbana, Ill. (illustrated).

(3) "Developments in Porcelain Dinnerware Bodies" by A. G. SIMON, Pickard, Inc., Antioch and Chicago, Ill.

**Officers for 1941–1942**

*Chairman:* EDWARD E. BLANKENSTEIN, Western Electric Co., Cicero, Ill.
*Vice-Chairman:* HENRY G. FISK, Armour Institute, Chicago, Ill.
*Secretary-Treasurer:* CHARLES R. FILIPPI, Illinois Brick Co., Chicago, Ill.

—CHARLES R. FILIPPI, *Secretary*

## SOUTHERN CALIFORNIA SECTION

Members of the Southern California Section held a meeting on January 24, 1941, at Carl's Café. The dinner meeting was attended by approximately sixty-five persons. Following the election of officers for 1941–1942, the discussion of the evening was led by John Iliff of the Harshaw Chemical Co., Cleveland, Ohio, whose subject was "Degrees of Opacity and Whiteness in Enamels."

**Officers for 1941–1942**

*Chairman:* J. GORDON STEWART, Braun Corporation, Los Angeles, Calif.
*Vice-Chairman:* JOE E. STEVENS, Emsco Refractories Co., South Gate, Calif.
*Secretary-Treasurer:* RALPH H. MARTIN, Vernon Potteries, Ltd., Los Angeles, Calif.

—RALPH H. MARTIN, *Secretary*

## PACIFIC NORTHWEST CLAYWORKERS' ASSOCIATION

The Pacific Northwest Clayworkers' Association held its winter meeting at the Mines Laboratory, University of Washington, Seattle, Wash., Saturday, February 8. Forty-seven members from Washington, Oregon, Idaho, and British Columbia attended the day sessions.

The program was as follows:

(1) Welcome by MILNOR ROBERTS, Dean, College of Mines.

(2) "Materials Handling" by JOHN B. STIRRAT, Seattle Brick & Tile Co., Seattle, Wash.

(3) "Cavity Wall Construction" by HARRY R. KREITZER, Columbia Brick Works, Portland, Oreg.

(4) "Temporary and Permanent Construction at Military and Naval Establishments" by MARION D. SAINDON, Chehalis Brick & Tile Co., Chehalis, Wash.

(5) "Washington at Work" (program of Gladding, McBean & Co. plant at Renton, Wash.) by J. E. BOWEN.

(6) "Iowa Brick Industry" by O. J. WHITTEMORE, JR., Univ. of Washington.

(7) "Glazed Tile Units" by JERRY JOHNSON, Washington Brick, Lime & Sewer Pipe Co., Dishman, Wash.

(8) "Some Tunnel-Kiln Operations" by L. A. MARTIN, Gladding, McBean & Co., Renton, Wash.

(9) "Power Costs" by JOHN KREITZER, Columbia Brick Works, Portland, Oreg.

(10) "Practical Application of Grain-Sizing and Its Relation to Pressing Practice" by JACK CUNLIFFE, Sumas Firebrick Co., Ltd., New Westminster, B. C., Canada.

(11) "Mechanism of Drying" by WENDELL P. KEITH, Univ. of Washington.

(12) "Control of Drying in Tunnel Driers" by GEORGE B. EVERLY, Univ. of Washington.

(13) "Nature of Clays and Alteration of Their Physical Properties by Chemical Additions" by C. H. ZWERMANN, Univ. of Washington.

Eighty persons enjoyed the evening banquet at the Edmond Meany Hotel. Frank Carson of Gladding, McBean & Company acted as toastmaster. Frank Drake Davison spoke on "Winston Churchill: The Man and His Background." The meeting ended with the showing of the Gladding, McBean & Company colored movie with sound effects, "The Romance of Pottery."

**Officers for 1941–1942**

*President:* MARION D. SAINDON, Chehalis Brick & Tile Co., Chehalis, Wash.
*Vice-President:* ARTHUR HOULAHAN, Builders Brick Co.
*Treasurer:* H. O. THOMPSON, Builders Brick Co.
*Secretary:* CARL H. ZWERMANN, Univ. of Washington, Seattle, Wash.

—CARL H. ZWERMANN, *Secretary*

## A.S.T.M. COMMITTEE C-15 REPORT

**Brick, Filter Block, and Related Standards**

The most important item acted on at the meeting of Committee C-15 on Manufactured Masonry Units held during A.S.T.M. Committee Week in Washington, D. C., at the Mayflower Hotel, March 3 to 7, 1941, was the acceptance for a committee letter ballot of the proposed tentative specifications for filter block. This proposed standard is a result of requests received by the Committee to establish purchase specifications for this type of vitrified clay and shale block used in sewage and water-purification plants.

The Committee also accepted a recommendation from its Working Committee on Test Methods to refer to letter ballot for adoption as standard the present Tentative Method of Freezing-and-Thawing Test of Brick (C67–

39T) and to include this in the general test methods for brick (C67–39).

The Subcommittee on Clay Building Brick has announced that an extensive revision is in preparation on the present Tentative Specifications for Building Brick (Made from Clay or Shale) (C62–40T).

Action was taken on several minor revisions in the specifications for structural clay tile to clarify certain features of the present standards.

The officers of Committee C-15 are *Chairman:* D. E. PARSONS, Chief, Masonry Construction Section, National Bureau of Standards, Washington, D. C.; and *Secretary:* J. W. WHITTEMORE, Professor of Ceramic Engineering, Virginia Polytechnic Institute, Blacksburg, Va.

## A.S.T.M. COMMITTEE C-8 ON REFRACTORIES ACTS ON SPECIFICATIONS

Committee C-8 on Refractories has completed an active year, culminating in the publication in a Refractories Manual of all of its specifications, tests, definitions, and related information. It has also approved for reference to letter ballot several important actions, chiefly the adoption as standard of numerous existing tentative specifications and tests.

One of the major projects during 1940 was the incorporation in its purchase specifications of the new classification of fire-clay brick and in revising these standards, which covered materials for malleable furnaces, for stationary boiler service, and for refractories for the construction of incinerators. They were rewritten in the form of tentative specifications, and the one for stationary boiler service was divided into two documents covering heavy-duty and moderate-duty service. These four specifications were approved for adoption as standards at the Washington meeting. The Tentative Classification of Insulating Block and Insulating Fire Brick (C155–40T), issued in 1940 and based on shrinkage as determined by heat treatment at specified temperatures and by bulk density, is to be revised; the bulk specific gravity will be lowered, and the specifications then will be continued as tentative.

Other tentative standards to be adopted include those covering Methods of Chemical Analysis of Chrome Ore and Chrome Refractories (C18–40T), Classification of Fire-Clay Refractories (C27–40T), Method of Test for Warpage of Refractory Brick and Tile (C154–40T), and certain tentative definitions of terms which were issued under the designation, C71–40T.

Tentative revisions were published in 1940 for trial in the Standard Specifications for Ground Fire Clay (C105). The screen-size requirements were to be made more rigid, a super-duty class of clay was incorporated, and methods were prescribed for sampling shipments of ground clay in bulk and in containers. All of these changes, which appear in the 1940 Supplement, Part II, of the Book of A.S.T.M. Standards and also in the Manual of A.S.T.M. Standards on Refractory Materials, are to be adopted.

Certain additions to its standard symbols for heat transmission were published in 1940, covering specific heat, density, and other subjects, and these are to be incorporated in the Standard, C108.

A new specification covering fire-clay plastic refractories for boiler furnaces and incinerator service is under preparation; the requirements have been considered, but the group in charge is not quite ready to submit this to the main committee for approval. This action, however, is anticipated at the fall meeting, which will be held in conjunction with the Autumn Meeting of the Refractories Division of The American Ceramic Society early in September, 1941.

There was a brief discussion of the extensive work of the Subcommittee on Industrial Surveys. Nine of these extensive reports have been prepared, comprising about sixty pages of the Refractories Manual; the latest two cover the Portland cement industry and stationary steam boilers. Another survey is under way covering the use of refractories in the zinc industry.

The officers of Committee C-8 are *Chairman:* J. D. SULLIVAN, Battelle Memorial Institute, Columbus, Ohio; and *Secretary:* S. M. PHELPS, Director of Research and Tests, Refractories Fellowship, Mellon Institute, Pittsburgh, Pa.

## A.S.T.M. COMMITTEE C-14 ON GLASS AND GLASS PRODUCTS

Subcommittee III held a meeting in Baltimore, Md., the evening of April 2, 1941. The members of this Committee are G. E. Barton, O. G. Burch, A. N. Finn, F. C. Flint, E. N. Gathercoal, J. F. Greene, C. E. Heussner, C. F. Hill, F. L. Jones, E. F. Kelly, C. W. Kendall, W. R. Lester, G. E. F. Lundell, Joseph Majeski, H. R. Moulton, D. D. Schurtz, D. E. Sharp, A. L. Simison, W. C. Taylor, R. W. Wampler, and H. F. Wilkie.

The officers of Committee C-14 are as follows:

*Chairman:* G. W. MOREY, Geophysical Laboratory, 2801 Upton St., N. W., Washington, D. C.

*Vice-Chairman:* U. E. BOWES, Owens-Illinois Glass Co., Toledo, Ohio

*Secretary:* LOUIS NAVIAS, General Electric Co., Schenectady, N. Y.

—F. W. ADAMS, *Sub-Committee Chairman*

## GLASS DIVISION COMMITTEE ON PHARMACOPOEIA GLASS

The Glass Division has a committee, newly appointed, to act with the Revision Committee of the United States Pharmacopoeia. The members of the Committee are as follows:

F. C. FLINT, *Chairman;* Hazel-Atlas Glass Co., Washington, Pa.
G. D. BEAL, Mellon Institute, Pittsburgh, Pa. (Chairman from the U.S.P.)
U. E. BOWES, Owens-Illinois Glass Co., Toledo, Ohio
F. S. BRACKETT, National Institute of Health, Washington, D. C.
A. N. FINN, National Bureau of Standards, Washington, D. C.
W. R. LESTER, Maryland Glass Corp., Baltimore, Md.
J. T. LITTLETON, Corning Glass Works, Corning, N. Y.
K. C. LYON, Armstrong Cork Co., Millville, N. J.
E. D. MCALISTER, Smithsonian Institute, Washington, D. C.
D. E. SHARP, Hartford-Empire Co., Hartford, Conn.
E. W. TILLOTSON, Mellon Institute, Pittsburgh, Pa.

Dr. Beal, Chairman of the Organic Chemicals Committee of the U.S.P. Revision Committee, is the chairman from the U.S.P.

At a meeting in Washington, D. C., light transmission in glass was discussed, which will lead to studies, particularly by the U.S.P., on the light sensitivity in chemicals. A report was presented to the Glass Division in Baltimore, Md., on April 2.

## ROSTER CHANGES DURING FEBRUARY AND MARCH *

**Corporation**

STUPAKOFF LABORATORIES, INC. (S. H. Stupakoff), Box 390, Latrobe, Pa. (Pittsburgh, Pa.)

**Personal**

ARNOLD, R. E., 1322 Cherry St., Pottstown, Pa. (Akron, Ohio)

AXFORD, VINCENT, Jeffery-DeWitt Insulator Corp., Kenova, W. Va. (Knoxville, Tenn.)

* Address in parentheses is former address.

BARNS, JAMES F., 326½ West 3rd St., Mansfield, Ohio (Shaker Heights, Ohio)
BERKELHAMER, LOUIS H., U. S. Bureau of Mines, Southern Experiment Sta., University, Ala. (Saranac Lake, N. Y.)
BLAU, H. H., Federal Glass Co., 515 E. Innis Ave., Columbus, Ohio (Corning, N. Y.)
BOLTON, HARRY L., Philadelphia Quartz Co., 121 S. Third St., Philadelphia, Pa. (formerly in name of John D. Carter)
BUCHHOLZ, RUSSELL A., 11 Klauder Rd., Kenmore, N. Y. (East Liverpool, Ohio)
CLEMENTS, J. A., Shaws Glazed Brick Co., Ltd., Whitebirk Works, Darwen, Lancashire, England (formerly in name of Thomas Phillips)
CONNER, HARVEY, Avoca, N. Y. (Kingston, N. Y.)
CONOVER, RAY C., Box 443, Homestead, Pa. (East Chicago, Ind.)
COOK, HERMAN L., O. Hommel Co., 209 Fourth Ave., Pittsburgh, Pa. (Muskegon, Mich.)
CRAMER, WILLIAM R., 5434 Howe St., E. E., Pittsburgh, Pa. (York, Pa.)
FALLON, FRANK J., 8817 81st Rd., Glendale, N. Y. (Leonia, N. J.)
GILES, ROY T., 331 Rebault Ave., Daytona Beach, Fla. (New York, N. Y.)
GOIN, FRED L., 2042½ Clinton Ave., Alameda, Calif. (Oakland, Calif.)
GORMLY, ALAN L., Shrewsbury St., Holden, Mass. (Worcester, Mass.)
HAVERKAMP, EUGENE, Crane Apts., Mason City, Iowa (Orange City, Iowa)
HILL, CLARENCE H., JR., 40th Ordnance Company, Aberdeen Proving Ground, Md. (Milltown, N. J.)
HOFFMAN, JOSEPH L., 10 N. Ellis Sta., Cape Girardeau, Mo. (Uhrichsville, Ohio)
JONES, RODNEY A., c/o Mrs. Nina Dennis, Jasper, N. Y. (Trenton, N. J.)
KLINEFELTER, T. A., U. S. Bureau of Mines, Southern Experiment Sta., Tuscaloosa, Ala. (Washington, D. C.)
LESAR, ALBERT R., Montezuma, Ind. (Urbana, Ill.)
LESTER, FRANK P., 150 Riverside Dr., New York, N. Y. (formerly in name of Frank Lichtenstern)
LOBAUGH, FRANK E., Atlas Lumnite Cement Corp., Chrysler Bldg., New York, N. Y. (Alfred, N. Y.)
MARTIN, RALPH H., 2300 E. 52nd St., Los Angeles, Calif. (formerly in name of Armin L. Schreiber)
MCBERTY, R. K., R. D. 1, Galion, Ohio (Tarentum, Pa.)
MCDOWELL, SAMUEL J., American Lava Corp., Chattanooga, Tenn. (Metuchen, N. J.)
MUELLER, JAMES I., 6th Company, N.C.O.I.C., Fort Belvoir, Va. (Anderson, Ind.)
SMITH, FRANK A., R.F.D. 1, Box 481, Lafayette, Calif. (Berkeley, Calif.)
SOMMERVILLE, JAMES L., Owens-Illinois Glass Co., Bridgeton, N. J. (Alton, Ill.)
STEELE, RICHARD E., 32 Easton St., Lowville, N. Y. (Indianapolis, Ind.)
STONE, C. P., Ferramic Industries, Ltd., Hydeway, Welwyn Garden City, Hertfordshire, England (formerly in name of A. H. Bridges)
STONE, ROBERT L., Box 181, Alfred, N. Y. (Mount Airy, N. C.)
STRAIGHT, LEE H., Reception Center, Jefferson Barracks, Mo. (Fort Leavenworth, Kans.)
SUTTON, W. J., Alfred, N. Y. (Fukien, China)
TETRICK, JAMES D., E. I. du Pont de Nemours & Co., Inc., R. & H. Chemicals Dept., Ceramic Div., Perth Amboy, N. J. (Catonsville, Md.)
TOSTLEBE, H. M., Box 2908, Brentwood, Mo. (Clayton, Mo.)

## NEW MEMBERS FOR FEBRUARY-MARCH

### Corporation

MEXICO REFRACTORIES CO., C. A. Smith (voter), Mexico, Mo.
OHIO HYDRATE & SUPPLY CO., A. H. Neiman (voter), Woodville, Ohio.

### Personal

AITKEN, IRENE A., 27931 Gilchrist Dr., Cleveland, Ohio; art instructor, Central Senior High School.
ALONSO, JOSÉ J. CERDEIRAS, Bv. España 2684, Montevideo, Uruguay, South America; professor, Univ. of Montevideo.
ANTHONY, GEORGE F., 1021 Huey St., New Castle, Pa.; foreman, Universal Sanitary Mfg. Co.
*BLUMENTHAL, GEORGE, JR., 205 S. Dithridge St., Pittsburgh, Pa.; Golding-Keene Co., Keene, N. H.
DAWSON, JOHN A. M., Canada China Clay, Ltd., 1001–1005 Federal Bldg., 85 Richmond St., W., Toronto, Ont., Canada; director of research.
GARDEN, HENRY R., JR., Old Virginia Brick Co., Salem, Va.; superintendent.
GATES, R. WAYNE, 738 Washington Ave., Carnegie, Pa.; ceramist, O. Hommel Co.
HARRIS, SAMUEL J., Holophane Co., Inc., Newark, Ohio; research engineer.
HOLLAND, J. B., Box 120, Port Hope, Ont., Canada; superintendent, Port Hope Sanitary Mfg. Co., Ltd.
JOHNSTON, MEREDITH W. B., R. D. 2, Miller Ave., New Castle, Pa.; draftsman, Universal Sanitary Mfg. Co.
JOHNSTON, PHILIP S., 421 N. Calhoun, Mexico, Mo.; A. P. Green Fire Brick Co.
KOHLI, MADAN M., 7, Empress Rd., Lahore, Punjab, India; glass manufacturer.
LEE, VIRGIL J., 638 Arkansas St., Lawrence, Kans.; ceramic assistant, Design Dept., Univ. of Kansas.
*MERRY, E. B., Merry Brothers Brick & Tile Co., 415 Masonic Bldg., Augusta, Ga.; vice-president.
*MILLIKEN, EDWARD, Bowerston Shale Co., Bowerston, Ohio; president.
MONTGOMERY, DOROTHY F., R. D. 4, West Chester, Pa.; teacher, Bryn Mawr Art Center.
SCHWARTZ, FREDERICK W., 925 Fordham Ave., Pittsburgh, Pa.; ceramic engineer, Homestead Works, Carnegie-Illinois Steel Co.

### Student

*University of Alabama:* M. HERSHEL EMISON and SIDNEY GOTTLIEB.
*Georgia School of Technology:* JAMES R. ALLEN, D. N. BROWN, SID COHEN, and E. EPSTEIN, JR.
*University of Illinois:* FRANK KLANE.
*Iowa State College:* MARTIN BAKER, EDGAR G. NODURFT, and L. H. VAN VLACK.
*New York State College of Ceramics:* FRANK C. ARRANCE, BURTON E. BAKER, M. DOUGLAS BEALS, ROBERT H. DOWS, ELTON S. GAMBLE, EDWARD W. GEHRKE, ROY W. HARDENBROOK, GEORGE W. KELLOGG, LLOYD W. MASON, JAMES PROKOPEC, RALPH RHODES, JR., LEO M. SCHIFFERLI, JR., MILTON TUTTLE, CLARENCE E. WASHBURN, and S. E. WOOLEY.
*Ohio State University:* J. ALLEN PIERCE.
*Pennsylvania State College:* PAUL LAZAR.
*University of Pittsburgh:* KUAN-HAN SUN.
*University of Saskatchewan:* HENRY TODD and ARNOLD P. WELCH.
*University of Washington:* ALLEN J. ERICKSON.

## MEMBERSHIP WORKERS' RECORD

### Corporation

| | | | |
|---|---|---|---|
| C. A. Freeman | 1 | Office | 1 |

### Personal

| | | | |
|---|---|---|---|
| A. A. Ayars | 1 | Donald Hagar | 2 |
| J. R. Beam | 1 | E. M. Hommel | 1 |
| R. E. Bevis | 1 | W. K. McAfee | 1 |
| J. L. Carruthers | 1 | Norman Plummer | 1 |
| C. B. Delgado | 1 | R. R. Robinson | 1 |
| Mrs. A. R. Dyer | 1 | Edward Schramm | 1 |
| C. A. Freeman | 1 | J. W. Whittemore | 1 |
| | | Office | 2 |
| Colleges | 31 | **Grand Total** | **50** |

* Former member of The Society rejoining.

# All Successful Enterprises Require

# Coming Together
# +
# Keeping Together
# +
# Working Together

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## FOR CERAMISTS—THE AMERICAN CERAMIC SOCIETY

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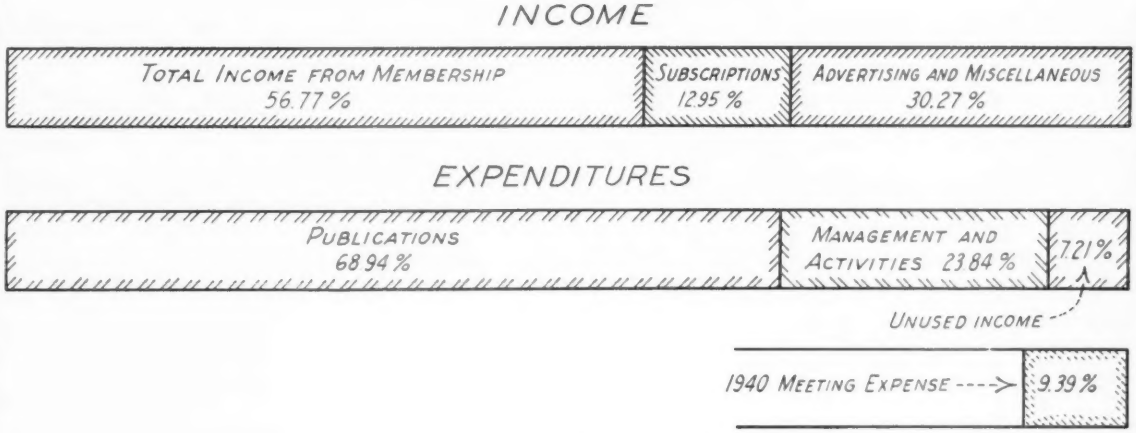
**The Membership Committee, Don Hagar, Chairman, reports progress.**

**Paid Membership Record**

| Date of Record | Members Paid | | Deferred | Subscriptions | Monthly Sales | Total Circulation |
|---|---|---|---|---|---|---|
| | Personal | Corporation | | | | |
| December 20, 1940 | 1995 | 260 | 25 | 574 | 220 | 3074 |
| January 20, 1941 | 2007 | 262 | 27 | 594 | 220 | 3110 |
| March 10, 1941 | 2023 | 257 | 26 | 620 | 220 | 3146 |

## WHY CORPORATION MEMBERSHIP SUPPORT?
## WHY MEETING REGISTRATION FEES?
## HERE, GRAPHICALLY, ARE THE ANSWERS

**Based on 1940 Total Income**




(1941)

## HISTORICAL DATA ON THE AMERICAN CERAMIC SOCIETY

| Year | Meeting Place | President Elect | Vice-President Elect |
|---|---|---|---|
| 1899 | Columbus, Ohio | H. A. Wheeler (general) | Ernest Mayer |
| 1900 | Detroit, Mich. | Karl Langenbeck (general) | C. F. Binns |
| 1901 | Old Point Comfort, Va. | C. F. Binns (art) | Ernest Mayer |
| 1902 | Cleveland, Ohio | Ernest Mayer (whiteware) | F. W. Walker, Sr. |
| 1903 | Boston, Mass. | E. C. Stover (whiteware) | Heinrich Ries |
| 1904 | Cincinnati, Ohio | F. W. Walker, Sr. (whiteware) | A. V. Bleininger |
| 1905 | Birmingham, Ala. | W. D. Gates (terra cotta) | Ellis Lovejoy |
| 1906 | Philadelphia, Pa. | W. D. Richardson (structural clay) | Samuel Geijsbeek |
| 1907 | St. Louis, Mo. | S. G. Burt (art) | R. C. Purdy |
| 1908 | Columbus, Ohio | A. V. Bleininger (whiteware) | Charles Weelans |
| 1909 | Rochester, N. Y. | R. C. Purdy (general) | A. S. Watts |
| 1910 | Pittsburgh, Pa. | Heinrich Ries (general) | R. R. Hice |
| 1911 | Trenton, N. J. | Charles Weelans (whiteware) | L. E. Barringer |
| 1912 | Chicago, Ill. | A. S. Watts (general) | C. W. Parmelee |
| 1913 | Washington, D. C. | Ellis Lovejoy (structural clay) | A. F. Hottinger |
| 1914 | Wheeling, W. Va. | C. W. Parmelee (general) | D. T. Farnham |
| 1915 | Detroit, Mich. | R. R. Hice (structural clay) | R. T. Stull |
| 1916 | Cleveland, Ohio | L. E. Barringer (whiteware) | F. K. Pence |
| 1917 | New York, N. Y. | G. H. Brown (general) | C. E. Jackson |
| 1918 | Indianapolis, Ind. | H. F. Staley (enamel) | A. F. Greaves-Walker |
| 1919 | Pittsburgh, Pa. | R. T. Stull (structural clay) | R. H. Minton |
| 1920 | Philadelphia, Pa. | R. H. Minton (whiteware) | E. T. Montgomery |
| 1921 | Columbus, Ohio | F. K. Pence (whiteware) | F. B. Ortman |
| 1922 | St. Louis, Mo. | F. H. Riddle (whiteware) | E. Ward Tillotson |
| 1923 | Pittsburgh, Pa. | A. F. Greaves-Walker (refractories) | R. D. Landrum |
| 1924 | Atlantic City, N. J. | R. D. Landrum (enamel) | R. M. Howe and August Staudt |
| 1925 | Columbus, Ohio | E. Ward Tillotson (glass) | F. H. Rhead |
| 1926 | Atlanta, Ga. | R. L. Clare (terra cotta) | B. Mifflin Hood |
| 1927 | Detroit, Mich. | B. Mifflin Hood (structural clay) | M. C. Booze |
| 1928 | Atlantic City, N. J. | M. C. Booze (refractories) | R. R. Danielson |
| 1929 | Chicago, Ill. | G. A. Bole (general) | F. A. Harvey |
| 1930 | Toronto, Canada | Edward Orton, Jr. (general) | P. E. Cox |
| 1931 | Cleveland, Ohio | E. V. Eskesen (terra cotta) | Alexander Silverman |
| 1932 | Washington, D. C. | E. P. Poste (enamel) | W. Keith McAfee |
| 1933 | Pittsburgh, Pa. | J. C. Hostetter (glass) | L. J. Trostel |
| 1934 | Cincinnati, Ohio | W. Keith McAfee (whiteware) | J. M. McKinley |
| 1935 | Buffalo, N. Y. | J. M. McKinley (refractories) | F. C. Flint |
| 1936 | Columbus, Ohio | F. C. Flint (glass) | R. B. Sosman |
| 1937 | New York, N. Y. | R. B. Sosman (refractories) | V. V. Kelsey |
| 1938 | New Orleans, La. | V. V. Kelsey (materials) | A. I. Andrews |
| 1939 | Chicago, Ill. | A. I. Andrews (enamels) | J. L. Carruthers |
| 1940 | Toronto, Canada | J. L. Carruthers (terra cotta) | J. T. Littleton |
| 1941 | Baltimore, Md. | J. T. Littleton (glass) | P. D. Helser |

# SCHOOL NOTES

## VIRGINIA POLYTECHNIC INSTITUTE

**Student Branch Meetings**

On February 6, the Student Branch of The American Ceramic Society sponsored the showing of films which were loaned through the courtesy of the U. S. Bureau of Mines.

The last group meeting of the winter quarter was held on February 20 in the McBryde Building. B. M. Norvell gave a talk on "Manufacture of Glass Blocks" and J. E. Funnell presented a paper on "Manufacture of Portland Cement."

—JOHN E. FUNNELL, *Secretary*

## IOWA STATE COLLEGE

The Iowa State College Student Branch of The American Ceramic Society held its first meeting of the winter quarter in Cyclone Cellar of Memorial Union with twenty members present. Lynn Hummel, assistant professor in the general engineering department, spoke on "Why Engineering?"

The Student Branch has established an award of a Student Membership to The American Ceramic Society to be given to the Junior Ceramic Engineer having the highest scholastic average. Lawrence Van Vlack, who had an all-college average of 3.559, on the basis of 4.0, was presented the award at the end of the business meeting.

—GEORGE B. HUGHES, *Corresponding Secretary*

## UNIVERSITY OF NORTH CAROLINA

**Student Branch Meetings**

At the regular meeting of the University of North Carolina Student Branch on February 4, tentative plans were made for the annual Engineers' Fair to be held in April.

Dean Blake R. Van Leer of the School of Engineering spoke on "Engineering Training for National Defense."

On March 4, the Student Branch held a meeting in the Ceramic Building. Qualifications of seniors for initiation as Knights of St. Patrick, honorary designation for outstanding engineers, were discussed. Further plans were discussed for the ceramic exhibit at the annual Engineers' Fair and St. Pat's celebration to be held April 18 and 19.

The sound film, "Manufacture of Abrasives," made by the Bureau of Mines and the Carborundum Co., was shown, which described the preparation of material and the forming, firing, and testing of abrasives. Color inserts of the crystalline silicon carbide were shown to display the multitude of iridescent hues found in the mass.

Throughout the film, the relation of abrasives to industry was stressed.

The entire senior class attended the Annual Meeting of The American Ceramic Society in Baltimore.

#### Honoraries

Six out of the twenty-four freshmen who have already selected ceramic engineering as their curriculum were elected to Phi Eta Sigma, freshman scholarship honorary, and were initiated on February 13. This is the highest percentage to be elected of any of the departments in the School of Engineering.

Howard L. Miller, a junior, was elected to Tau Beta Pi, engineering honorary.

#### Keramos

On February 20, the members of Keramos assisted in a day of entertainment for the one hundred and twenty South Americans attending the six-week winter "Summer School" being held at the University. The visitors are chiefly students, both men and women, from South American universities, who are attending regular courses in which they are most interested.

## OHIO STATE UNIVERSITY

#### Student Branch Meetings

At the meeting held on January 23, 1941, A. M. Caito, athletic chairman, announced the success of the three department bowling teams who hold first place in their respective flights; a motion was made and passed to buy jerseys for the basketball team bearing the letters "A C S"; and plans were made to have a ceramic dinner in Pomerene Hall before the Engineer's Prom on February 7. L. M. Merritt, Safety Engineer for the Ohio Industrial Commission, Columbus, Ohio, spoke on "Dust Hazards in Ceramics" and he discussed the effect of silicosis in ceramic industries. R. G. Sada, a student from Mexico, showed films of his father's glass plant in Monterrey, Mexico, as well as some color films of Mexican bullfights.

The Student Branch met February 5, 1941, at the offices of The American Ceramic Society. R. C. Purdy, General Secretary of The Society, discussed and described various articles found in the extensive museum in the executive offices. W. C. Bell of the Engineering Experiment Station discussed and showed slides on the subject of "Glaze Fit."

—R. H. Thomas, *Secretary*

## MISSOURI SCHOOL OF MINES AND METALLURGY

The Missouri School of Mines and Metallurgy Student Branch of The American Ceramic Society met on March 5 and were entertained by the U. S. Bureau of Mines movie "Asbestos."

During the business meeting which followed, several projects were discussed, including plans for a picnic and the making of ashtrays. It was also planned to issue a paper concerning the activities of the students and the school, which will be sent to those interested about the middle of April. Refreshments were served at the conclusion of the meeting.

—Paul G. Herold

## RUTGERS UNIVERSITY, 1766 TO 1941

The one hundred and seventy-fifth anniversary of the founding of Rutgers University as Queen's College under the charter granted by His Majesty George the Third on November 10, 1766, will be observed during the year 1941. The celebration will be concluded with special exercises the second week in October. On Thursday and Friday, the ninth and tenth, symposia will be held in the Natural Sciences, the Applied Sciences, the Social Sciences, and Literature and the Fine Arts. The formal anniversary convocation will occur on Saturday, October eleventh. Delegates from other colleges and universities and from learned societies will be the guests of the University.

—Robert C. Clothier, *President*

## NEW YORK STATE COLLEGE OF CERAMICS

#### Changes in Staff

M. E. Holmes, Dean, has announced the resignation from the staff of the New York State College of Ceramics of Frank E. Lobaugh and C. Major Lampman and the appointment of Robert L. Stone to take the place vacated by Professor Lobaugh and the appointment of Frank C. Arrance to take the place vacated by Mr. Lampman.

Frank E. Lobaugh

Frank E. Lobaugh for the past ten years has been assistant professor of ceramic engineering and research ceramist. During that time, he has made an excellent record as a professor and as a research worker. He has carried on extensive research work, which has led indirectly to his new position. His resignation was effective February 1, 1941, at which time he took up his new duties at the Atlas Lumnite Cement Co., New York, N. Y., as service director in charge of technical development.

#### C. M. Lampman

C. Major Lampman was graduated from the New York State College of Ceramics in 1936. Since that time he has been serving on the research staff of the Ceramic Experiment Station of the New York State College of Ceramics and has made an enviable record as a research worker. He is the author of many technical publications and has been active in the work of the College. He resigned on January 1, 1941, to accept an offer with the General Electric Company, where he is employed on the research staff at the Pittsfield, Mass., plant.

### R. L. Stone

Robert L. Stone began his duties as assistant professor of ceramic engineering on February 1, 1941. He was graduated from the University of Missouri School of Mines in 1934, serving during the last year of his residence there as assistant in the Missouri Clay Testing and Research Laboratory. He then went to the North Carolina State College as a teaching fellow. In 1936, he received his degree of Master of Science in Ceramic Engineering and later he received a professional degree of Ceramic Engineering from that institution. From 1936 to 1939, he was an instructor in the Department of Ceramics at the North Carolina State College and a junior partner in the firm of Greaves-Walker Engineers. During the summers, he has served as research ceramist for the Feldspathic Research Corporation and the Allied Engineering Company. This past year he has been plant manager for the Hale Manufacturing Company, Mount Airy, N. C.

Robert L. Stone

Professor Stone is a member of Keramos, Tau Beta Pi, Phi Kappa Phi National Honor Society, Sigma Pi Alpha, Institute of Ceramic Engineers, North Carolina Society of Engineers, Society for the Promotion of Engineering Education, and Sigma Pi Fraternity. He is the author of the following technical papers: "Ceramic Raw Materials," "Pyrometry," "Setting Heavy Clay Ware," "Metal Enamels," "Driers and Drying," and "Kilns and Firing"; "Development of Pyrophyllite Refractories and Refractory Cements"; "Development of Forsterite Refractories Employing N. C. Dunite"; "A New Theory of Spalling of Refractories"; "The Thermochemistry of N. C. Dunite in the Manufacture of Forsterite Refractories"; and "Effect of Evacuation on Ground-Coat Enamels."

Professor Stone is eminently qualified both by ability and experience for the duties he has taken up.

### Frank C. Arrance

Frank Arrance was graduated from the Department of General Ceramic Engineering at the New York State College of Ceramics in June, 1940. He made a brilliant record as a student and research worker. He was employed by the U. S. Steel Corporation until he resigned to accept his present position. He is now serving as research ceramist in the Department of Research.

Frank C. Arrance

## NECROLOGY

### FRANK E. BARDROF

Frank E. Bardrof, associate editor of *The Glass Industry*, died of Hodgkin's disease at his home in Shaker Heights, Ohio, on Wednesday, January 15. He was born in Oriskany Falls, N. Y., in 1889, and was educated in the schools of that city as well as at Cazenovia Seminary; he was graduated with high honors from the Rensselaer Polytechnic Institute in 1913, to which he was recalled as an instructor and there taught mechanical design.

In 1917, he became associated with the mechanical development department of Corning Glass Works, where he was engaged in the design and development of glass-making machinery for more than six years. It was during this period that Corning was perfecting its "399" or "ribbon" machine, and Mr. Bardrof did a great deal of the work on this. An associate at Corning has said that he was one of the best theoretical machine designers he had ever known.

At about this time, Mr. Bardrof had occasion to detect an error in a technical article appearing in *The American Machinist*, published by McGraw-Hill Co., and as a result of the ensuing correspondence he joined the staff as associate editor. His ability attracted the attention of one of the publication's advertisers, the Cleveland Worm and Gear Company, and he became sales manager of that Company, a position he held until 1929. In 1937, he joined the staff of *The Glass Industry*.

He is survived by his widow and two sons.

Mr. Bardrof had been a member of The American Ceramic Society since 1937.

Frank E. Bardrof

Seijo Kondo

## SEIJI KONDO

Seiji Kondo, Honorary Member of this Society, died suddenly of apoplexy at his home (Tokio, Japan) on June 25, 1940.

Dr. Kondo was born January 31, 1883, at Sakura Village in Mie Prefecture. He was graduated from the Department of Applied Chemistry, Faculty of Engineering, Tokio Imperial University, in July, 1906. He studied ceramics in the United States of America from March, 1915, to August, 1917. From March, 1915, to June, 1916, he studied at Ohio State University under Arthur S. Watts and the late Carl B. Harrop and under Albert V. Bleininger at the National Bureau of Standards from January to March, 1917. On October 27, 1919, he was granted the degree of Kogaku-hakusi (Doctor of Engineering) by the Minister of Education, his thesis having been applied to the Tokio Imperial University.

After graduation, he worked at the Nippon Brick Manufacturing Company. On November, 1911, he was appointed professor of ceramics at the Tokio Higher Technical School. Since April, 1929, he had been professor and chairman of the Department of Ceramic Engineering at the Tokio University of Engineering; and since January, 1918, he had been examiner at the Patent Bureau. He was elected president of the Japanese Ceramic Association in April, 1940.

For many years, he had been on the staff of abstracters for *Ceramic Abstracts*.

EDITOR'S NOTE: A life sketch of Dr. Kondo was published in the August *Bulletin*, p. 293, 1936, the year he was elected to Honorary Membership in The Society. He had been a member of The Society since 1916.

(1941)

## LEWIS E. SAUNDERS

Lewis E. Saunders, a vice-president of Norton Company, Worcester, Mass., and a pioneer in the development of electric-furnace abrasives, died on February 20, 1941,

Lewis E. Saunders

after an illness of two weeks. He was sixty-seven years old.

Mr. Saunders received the Bachelor of Science degree from the University of Rochester in 1897. He was then

associated in Ampere, N. J., with Charles B. Jacobs, who developed the process of making the aluminous abrasive known as Alundum (this product was acquired by Norton Company in 1900). Mr. Saunders also served as chemical engineer, metallurgist, and superintendent of abrasive plants and research laboratories and was long recognized as one of the nation's leading authorities on the electrochemical production of abrasives.

In 1903, he became associated with Norton Company, serving as vice-president since 1937 and a director since 1921. He also had been manager of the abrasive plants and research laboratories of the Company. In January, 1941, he gave up most of his active responsibilities and worked as a consultant until his death.

Mr. Saunders had been a member of The American Ceramic Society since 1921; a member of the American Electrochemical Society, the American Chemical Society, the Society of Chemical Industry of Great Britain, the Worcester Club, and the Tatnuck Country Club.

## A. J. LINDEMANN

A. J. Lindemann, who had been a Corporation Member of The American Ceramic Society since 1921, died at Columbia Hospital in Milwaukee, Wis., on March 12, 1941. He had been ill only two weeks. Mr. Lindemann would have been eighty-seven years old on March 26.

Mr. Lindemann was a Director and former President and Chairman of the Board of the A. J. Lindemann & Hoverson Co., stove manufacturers. He was also active in civic, educational, and Masonic activities.

Mr. Lindemann was born in Hamburg, Germany, March 26, 1854. In 1863, when the Civil War was in progress, he came to Milwaukee with his parents. He received a high-school education and learned the trade of tinsmith in the shop of William Frankfurth.

In 1870, having become a journeyman tinsmith, he went with his father to a southern Illinois coal town, where they opened a small shop. Five years later, when young Lindemann was twenty-one, they returned to Milwaukee and started Lindemann & Son, a little retail hardware store and tinsmith shop; a manufacturing department was added in 1879.

In 1890, Mr. Lindemann left the old company and organized the Lindemann & Hoverson firm, of which he was president for many years. The Company was started with a capital of $20,000, but it expanded rapidly. In 1900, the quarters became too small and the plant was moved to the present factory site at 601 W. Cleveland Ave. As the business expanded, oil, kerosene, gasoline, and gas stoves and finally electric ranges and appliances were added; branches were later established in New York, Chicago, Denver, and San Francisco.

To Mr. Lindemann went the credit for many of the improvements in stove manufacture. In 1916, he invented a coal or wood and gas combination range and an oil-burning stove, on which his firm holds the basic patents. He also played a prominent part in the development of electric ranges and appliances.

Mr. Lindemann continued as President of the Company until he was past eighty years of age. After the Lindemann-Hoverson strike of 1935, he gradually disassociated himself from the firm.

Interested in school affairs, he was at one time president of the old South Side Educational Association and was one of the principal advocates of the construction of South Division High School in Milwaukee, Wis.

In 1894, he was appointed to represent the fifth ward on the school board and was made president of that body. In 1897, he was a member of a committee which obtained the National Education Association convention for Milwaukee.

He was instrumental in helping to found the Milwaukee Trade School and for years was President of the special Trade School Board which governed the school until its administration was assumed by the regular school board.

From its foundation in 1912 to 1936, Mr. Lindemann was a member of the Board of Vocational Education, which governs the vocational school. For some years he was its president. He was one of those who developed the State of Wisconsin vocational school laws.

Mr. Lindemann was a leader in the Republican party in Milwaukee for many years. He was chairman of the Republican county committee for some years.

#### Author of Two Books

In 1903, he served as vice-president of the Wisconsin State Board of Managers of the St. Louis World's Fair. He was a director of the Milwaukee Association of Commerce and the National Manufacturers' Association and a member of the Wisconsin Manufacturers' Association. As a delegate of the national manufacturers he attended the first World Power Conference, a section of the British imperial exposition at London in 1924.

An extensive traveler, he wrote two books, Sketches from My Travels in Continental Europe, published in 1922, and An Alpine Tour Up Mount Jungfrau, published two years later.

He was a thirty-second degree Mason and a member of the Rotary Club, the Athletic Club of Milwaukee, and the Chicago Athletic Club. He was formerly a director of the Milwaukee Association of Commerce.

Mr. Lindemann is survived by three sons, Eugene A., Milwaukee, president of the stove firm; Walter C., Milwaukee, vice-president and secretary, and Albert L., Los Angeles, Calif., and a daughter, Mrs. Julia Amendt, Los Angeles. Mr. Lindemann's wife died six years ago.

# NOTES FOR CERAMISTS

## PORCELAIN ENAMEL INSTITUTE INVESTIGATION PROGRAM

#### Process Control Committee

The Process Control Committee of the Porcelain Enamel Institute met on March 8 at the Graemere Hotel in Chicago. This Committee is headed by E. W. Dietterle of the Century Vitreous Enamel Co.; other members present were Don Beal, Porcelain Enamel Manufacturing Co.; Wayne Duval, Chicago Vitreous Enamel Product Co.; Herman Cook, The O. Hommel Company; E. H. Shands, Roper Stove Co.; W. W. Carpenter, Ingram-Richardson Manufacturing Co. of Indiana; Charles S. Pearce, Porcelain Enamel Institute.

The Committee has decided to limit its work at the present time to an investigation of drawing compounds and cleaners; other parts of the pickling process will be studied at a later date.

#### Annual Meeting, April 17 and 18

The Porcelain Enamel Institute will hold its Tenth Annual Meeting at French Lick Springs Hotel, French Lick, Ind., April 17 and 18, 1941. The date of this meeting was established by the Board of Trustees for April so that every one in the industry would have an opportunity to enjoy two days at this beautiful spot in southern Indiana while transacting the necessary business.

## CENTRAL DISTRICT ENAMELERS' CLUB

The Central District Enamelers' Club held a meeting on Friday, March 14, at the Allerton Hotel, Cleveland, Ohio.

After dinner, attended by 110 members and guests, the following persons discussed new materials and equipment: Roy Beck, Tappan Stove Co., Mansfield, Ohio; Jack Trees, Holland Rieger Co., Sandusky, Ohio; Dan Cherry, Kelvinator Co., Grand Rapids, Mich.; N. H. Stolte, Davidson Enamel Co., Clyde, Ohio; and Frank Michael, General Electric Co., Erie, Pa.

—J. T. IRWIN, *Secretary*

## ROBERT A. WEAVER PRESENTS EUROPEAN ENAMELS TO THE CLEVELAND MUSEUM OF ART*

A slight change in a technical process or a new application of a well-tried technique may be all that is needed to give wings to a new industry. Such was the case in the latter part of the fifteenth century when the discovery was made that a piece of metal could be permanently coated with enamel if all portions were covered, the reverse as well as the face. This counter-enamel, often of no aesthetic importance, had the practical value of equalizing tensions and preventing thereby the peeling of the coated surfaces. A simple process, it brought about a renaissance of enamel craft in the so-called painted enamels of the late fifteenth and sixteenth centuries and is the basis of the commercial utilization of enamel at the present time. Here was a new and easily handled process. Here was a smooth and even coating on which designs in enamel could be painted at will, to be made permanent by a second firing.

The most important center for this new development was Limoges. Thus, this city in southwestern France became again the focal point for the commercial and artistic exploitation of an enamel process, just as it had been for champlevé enamel some three or more centuries earlier. There were other centers for painted enamel, but Limoges retained the primacy with a large production of high artistic excellence. The terms "Limoges" and "enamel" became at times almost synonymous.

The Museum has been fortunate in the presentation, by Robert A. Weaver, of a gift of two pieces of Limoges painted enamel of the classical sixteenth century and of a group of pieces of the eighteenth century, similar in technique but of varied European provenance.

### Oblong Plaque of Penicaud

The oblong plaque (from the Otto Kahn collection) given by Mr. Weaver is attributed to the third of the well-known Pénicaud family of enamelers, Jean Pénicaud, II, and can be dated in the decade after the turn of the half century, Pénicaud dying in 1588. Its subject is the "Quos Ego" of Virgil, and the design is a readaptation and telescoping of parts of the engraving by Marcantonio Raimondi entitled "Neptune Calming the Tempest." That in turn was based probably on a lost original by Raphael or his studio. To the left, Aeneas and Ascanius contemplate the construction of Carthage; to the right, Aeneas relates his adventures to Dido, who presses the youthful Ascanius to her breast. The piece is executed in grisaille, the typical gray monochrome, characteristic of much midsixteenth-century Limoges production.

### Grisaille Ewer Stand

From Mr. Weaver's private collection comes a ewer stand in grisaille with flesh tints and gilded scrolls. The plate bears the date, 1557, and the initials P. R. (Pierre Reymond), enameler of Limoges, born early in the sixteenth century and dying in 1584. It is one of a series of stands with similar subject material in famous collections; there is one in the Walters Collection in Baltimore, dated 1563; another, in the Basilewsky Collection in the Hermitage in Leningrad, dated 1558.

**Enamel Ewer Stand, French, Limoges, 1557, signed and dated by Pierre Reymond, c. 1513–1584.**

The Weaver piece, however, bears the earliest known date of this subject. The front is decorated with five scenes from Genesis: the Creation of Eve, God Speaking to Adam and Eve, the Temptation, the Expulsion, and Cain Killing Abel. The reverse shows a typical French Renaissance strapwork design, framing winged *putto* heads, and two draped figures bearing on their foreheads crescent moons.

The scenes from Genesis are taken in their essence from a series of engravings by Lucas Van Leyden, a Dutch artist completely impregnated with the Italian manner.

Reymond introduces new details not in the original engravings, such as the animals in the forest background; and he changes considerably the one scene, God Speaking to Adam and Eve. The Weaver plate, which is an earlier date, is closer in this scene to the original Van Leyden engraving than is the Walters piece. The other scenes remain almost identical throughout the various replicas. Reymond also changes the headdress; Eve's coiffure is contemporary with that of the plaque and not with that of the earlier Van Leyden engraving.

### English Eighteenth Century Pieces

All of the other pieces included in Mr. Weaver's gift are eighteenth century and probably English. This was a

* Article by William M. Milliken reprinted (in part) from the *Bulletin of The Cleveland Museum of Art*, No. 10, December, 1940.

time when there was much activity in this craft at Battersea near London and in South Staffordshire at a place called Bilston.

A tiny globe, a snuff box with a transfer calendar of church festivals, probably from Birmingham, a box in the shape of a shoe, a thimble holder, two bottle labels, a finely decorated cup and saucer, all represent objects both of utility and of a purely decorative nature. Some of them have the fashionable rose color, Rose pompadour, which came into use after 1760. All have that delicacy of touch and gaiety of mood which expresses the charming if frivolous spirit of the mid-eighteenth century.

The gifts from Mr. Weaver are particularly welcome in a city which is making a name for itself in the enamel field. An old craft has been revitalized here to develop, on one hand, toward purely aesthetic productions of high quality and, on the other, toward wide and valuable commercial utilization.

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## CRYSTALWARE IN THE MOVIES

American crystalware received nation-wide notice in February when it was featured throughout the country in RKO's film, "The Saint in Palm Springs," starring Wendy Barrie and George Sanders. Until 1940, almost all fine crystal used on motion-picture sets was imported, but the upswing in the American glass industry is now being reflected in Hollywood's choice of domestic products. The pattern chosen was the "Knickerbocker" in Libbey's modern American crystal, simply designed with square crystal bases; decorative vases and ash trays were used as props in the film. The prestige gained by such motion-picture use gives greatly increased impetus to the renaissance in fine American glass blowing that is already under way.

## CORNING MAKES CHRISTMAS-TREE ORNAMENTS

In spite of hostilities in Europe and the disruption of imports and because of the continuing investment in industrial research in the United States, Corning Glass Works, in its Wellsboro, Pa., Division, produced enough Christmas-tree balls, bells, and other ornaments in 1940 to prevent any shortage during the holidays.

For a time it looked as though this country would have no Christmas-tree ornaments because the chief sources of supply in Europe were cut off by the British blockade. Small shipments continued to arrive from Japan, but this volume has never been large. In 1937, a typical pre-war year, imports of Christmas-tree ornaments amounted to more than $1\frac{1}{4}$ million dollars; of this total, about 90% came from Germany and Czechoslovakia. In the first ten months of 1939, the value had dropped to $492,000 and, in 1940, it had gone down to $104,998 for a similar period. In 1940, 93% of our imported ornaments came from Japan, and the Germans were practically out of the market. The Japanese imports for 1940 amounted to $98,000 for the first 10 months as compared to $55,000 for the same period in 1937; but in 1937, a typical year of large imports, the Japanese ornaments were only 6% of the total amount.

Production costs in Europe were extremely low because the ornaments were made in the home. During the last war, the United States made an attempt to compete but was driven out of the market as soon as hostilities were over. The solution to the problem of making Christmas-tree ornaments inexpensively in America obviously required new methods by which they could be made by machinery and made very fast. In 1939, Corning Glass Works spent a good deal of time developing mass-production methods. These methods were proved to be successful in the last half of that year; one million bulbs were made experimentally, and about 90 additional persons were given employment in the factory. Five hundred people were employed in this work in 1940, additional improvements were introduced in the decorating processes, and about 40 million ornaments were produced.

**Decorating the Christmas tree (decorations made by Corning Glass Works).**

**Ornament Production**

Thirty-five tons of glass are melted at one time. When the glass becomes incandescent yellow-white and seems just right to the inspectors, who take the temperature with a polariscope, it is released in a steady stream onto an endless belt of steel sections. The molten glass is picked up by the belt and becomes a moving ribbon of about 3 inches wide and 13,000 miles long. Compressed air forced through apertures in the belt lets the glass form a series of red-hot globules as it runs along; in a matter of seconds, these become longer and begin to cool slightly. Ingenious cup-shaped molds carried by other endless-belt mechanism come into position around them, and in another second the glass in each mold has been puffed and blown. At the far end of the machine, which is as long as a locomotive, the bulbs are knocked off by a rotary hammer.

The bulbs, which are not yet colored, move on endless canvas belts into the annealer. In about 6 minutes, as they move gradually through the lehr, they have been reduced in temperature and are ready for decorating. They are cooled slowly to reduce strains in the glass.

Certain technical advantages are claimed for the American Yule ornaments. Because of the mechanism that produces them, they are more perfect spheres, which makes them stronger. The neck, ordinarily fragile on the imported ornaments, has been reinforced by adding a small amount of extra glass. The neck is also wider and shorter, which permits the caps to fit the glass more securely. There are about thirty ornaments to the pound of raw glass.

In 1940, Corning Glass Works made ornaments in a variety of styles and sizes; all of the million experimental bulbs made in 1939 were spheres. The globe form is easier to make by traditional glass-blowing methods. The range, however, has been extended to include a variety of shapes, known in the trade as "fancies"; these include such ornaments as bells, acorns, pine cones, and reflectors. There are six sizes of round ornaments, five colors, and six "fancies," including miniature lanterns. Counting the variety of shapes, there are 160 different units being produced.

## LIVING KITCHEN PERMANENT EXHIBIT AT SYRACUSE MUSEUM OF FINE ARTS

**Kitchen design**

**Designed by Allmon Fordyce**

The "living kitchen," designed by Allmon Fordyce for the "America at Home" building at the New York World's Fair, is being installed as a permanent exhibit in the Syracuse Museum of Fine Arts.

This is the first time that an art museum has undertaken the installation of a kitchen. The living kitchen will be an important factor in the Syracuse Museum, which is a community art center working with innumerable civic groups, and it can serve as a central meeting place for home economics students, home bureau members, and other women's organizations throughout the State.

Courses in the fine art of cooking are given along with the regular art courses at the University of the Sorbonne in Paris. Many museums have included, among their period rooms, ancient kitchens showing all the available antique equipment. The showing of modern kitchens, however, has been relegated to stores or other commercial enterprises. What could be more appropriate than the installation of a modern, beautifully designed kitchen in an art museum that seeks to promote better living, particularly beauty in every-day life?

**Description of Living Kitchen**

The "workshop" section of the living kitchen is separated from the "living-dining room" section by open shelves on which glass and other well-designed kitchen pottery and utensils may be displayed. Mr. Fordyce believes that the kitchen should again become the "living center" for the family, instead of being isolated from the rest of the house. "The story of this room," he states, "is the interrelationship of the various parts." The publication, *Pencil Points*, says, "It is interesting to find a designer making such daring, unconventional, and basically constructive contributions to the problem of actual living as it is carried on today."

The cabinets in the kitchen are of warm cypress wood, and the refrigerator and range have been enameled a soft, deep blue. It is a gay, cheerful kitchen, where wood and brick as well as modern glass and metal surfaces have been used. The blue, white, and green upholstery materials are contrasted with the red linoleum of the kitchen space and the brick of the hearth.

(1941)

**Dining room and kitchen showing shelves with books and art pieces.**

## EDWARD ORTON, JR., CERAMIC FOUNDATION FINANCIAL STATEMENT FOR 1940

| | |
|---|---|
| **Assets** | |
| Cash | $ 7,225.37 |
| Receivable | 6,622.32 |
| Reserve invested | 16,007.65 |
| Materials | 18,035.23 |
| Land, building, and equipment | 99,790.00 |
| TOTAL ASSETS | $147,680.57 |
| **Liabilities** | |
| Payable | $ 1,000.11 |
| Fellowships | 1,000.00 |
| | $2,000.11 |
| Net worth account | $149,430.46 |
| Less Fellowship | 3,750.00 |
| TOTAL NET WORTH | $145,680.46 |

It was General Orton's purpose and life ambition to create a foundation which would finance ceramic research. Accordingly in his will, he left his cone business to accomplish this purpose.

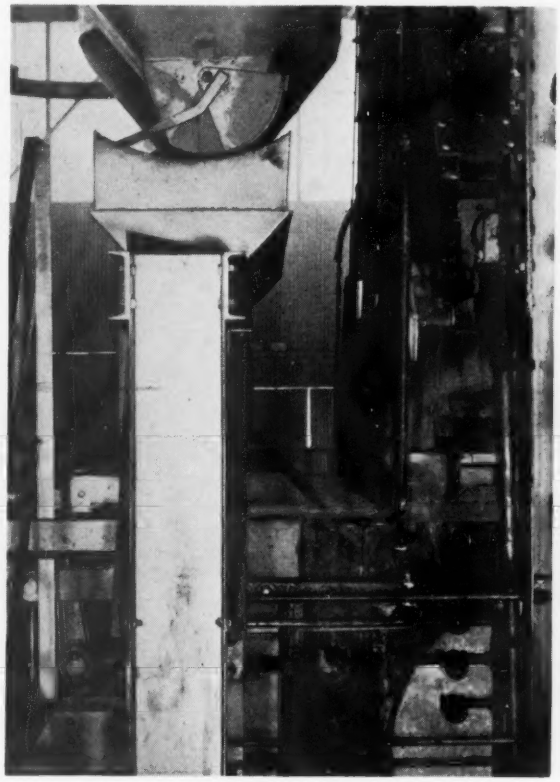
General Orton, in effect, has given his cone business to the ceramic industry of the nation.

## AIR HYGIENE FOUNDATION

H. B. Meller, Managing Director, has announced the election of V. P. Ahearn of Washington, D. C., as Secretary of the Board of Trustees and of Theodore C. Waters of Baltimore to the Board as General Counsel of Air Hygiene Foundation. John F. McMahon was promoted to Executive Secretary.

The Foundation, which is located at Mellon Institute, is a nonprofit organization of industrial concerns for the conservation of employee health throughout the industries. In addition to Mr. Ahearn, who is Executive Secretary of the National Industrial Sand Association, and Mr. Waters, Chairman of the Maryland Occupational Diseases Commission, the following trustees were re-elected:

Roger A. Hitchins, *Chairman* (President, General Refractories Co., Philadelphia); Andrew Fletcher, *Vice-Chairman* (Vice-President, St. Joseph Lead Co., New York); B. D. Saklatwalla, *Treasurer* (President, Alloys Development Corp., Pittsburgh); and Vandiver Brown, General Counsel, Johns-Manville Corp., New York; Joseph Dilworth, Assistant to President, Westinghouse Electric & Mfg. Co., Pittsburgh; J. Dewey Dorsett, Manager, Casualty Dept., Assoc. Casualty & Surety Executives, New York; Dan Harrington, U. S. Bureau of Mines, Washington, D. C.; R. R. Sayers, Director, U. S. Bureau of Mines, Washington, D. C., who represents the U. S. Public Health Service on the Board; A. W. Sherwood, retired, Dover, N. H.; W. P. Yant, Director, Research & Development, Mine Safety Appliances Co., Pittsburgh; and R. E. Zimmerman, Vice-President, U. S. Steel Corp., Pittsburgh.



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The Vitro Mfg. Co.

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Electro Refractories & Alloys Corp.
The Vitro Mfg. Co.

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The Vitro Mfg. Co.

**Aluminum Oxide (Fused)**
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Harshaw Chemical Co.
Norton Co.
The Vitro Mfg. Co.

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Harshaw Chemical Co.
The Hommel, O., Co., Inc.

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# THE MELTING CHARACTERISTICS OF PYROMETRIC CONES

THE melting characteristics of pyrometric cones depend, in large measure, upon the melting of the silicate minerals. At their melting temperature many of the silicates show very high viscosity and their melting is accompanied by a softening rather than by an abrupt passage into a liquid state.

The initial or first stage of melting is determined by the eutectic composition, and the amount of the melt formed at that temperature depends upon how much eutectic composition is in the silicate mixture.

The second stage of melting covers a range in temperature and the phenomenon involved is the solution of undissolved (or unmolten) minerals left after the eutectic has melted.

The softening depends also upon the viscosity of the melt, which in turn depends upon the composition of the minerals from which the melt has formed.

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Ingram-Richardson Mfg. Co. of Indiana, Inc.
Porcelain Enamel and Mfg. Co.
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Harshaw Chemical Co.
The Hommel, O., Co., Inc.
Ingram-Richardson Mfg. Co. of Indiana, Inc.
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**CLAY PROPERTY FOR SALE**

Tract of about 360 acres containing large deposit of clay suitable for various clay products. Property also contains sand and gravel.

Located on main line Pennsylvania Railroad midway between Baltimore and Washington and adjoins Fort Meade in Anne Arundel County, Maryland.

BLOEDE FARM CORPORATION
701 South Caton Avenue
Baltimore, Maryland

POTTERIES - PLASTIC MFG.

Patented sanitary-airtight-money-space saving, refrigerator pitcher.

Sanitary features alone, besides other ones, needed in every home, institution, etc.

A money maker for a live manufacturer. Royalty basis, write,

Dod Haslup
Grafton, West Virginia

FOR THE KILN ROOM

LOUTHAN HI-FIRE Refractories

PINS · STILTS · SPURS
DECORATING THIMBLES
FIRING RACKS
TILE SETTERS & PINS
DINNERWARE SETTERS & RINGS

WRITE FOR CATALOG

THE LOUTHAN MANUFACTURING CO.
CERAMIC SPECIALISTS SINCE 1901
NEW YORK EAST LIVERPOOL, OHIO LOS ANGELES

FOR SALE—One thousand acres (more or less) of finest ganister land. Situated opposite Pennsylvania Railroad. Located in Juniata and Mifflin Counties. Price reasonable. Address Box 85, Mifflintown, Pa.

Solvay Sales Corp.
The Vitro Mfg. Co.

**Producer Glass Plants**
Frazier-Simplex, Inc.

**Pug Mills**
Lancaster Iron Works, Inc.

**Pyrites (Natural Iron Sulphide)**
Foote Mineral Co.
The Hommel, O., Co., Inc.

**Pyrometer Tubes**
Carborundum Co.
Electro Refractories & Alloys Corp.
Montgomery Porcelain Products Co.

**Pyrometer Tubes (Refractory and Hard Porcelain)**
Denver Fire Clay Co.
Green, A. P., Fire Brick Co.
McDanel Refractory Porcelain Co.
Montgomery Porcelain Products Co.
Norton Co.

**Pyrometers (Optical, Radiation, Surface, Immersion, Needle)**
Leeds & Northrup Co.
Pyrometer Instrument Co.

**Pyrometric Cones**
Accurate Pyrometric Cone Co.
The Edward Orton, Jr., Ceramic Foundation

**Racks, Firing (Refractory)**
Louthan Mfg. Co.

**Raw Material Handling Equipment**
Frazier-Simplex, Inc.
Lancaster Iron Works, Inc.

**Refractometers**
Bausch & Lomb Optical Co.
Electro Refractories & Alloys Corp.
Spencer Lens Co.

**Refractories**
Carborundum Co.
Corhart Refractories Co.
Denver Fire Clay Co.
Green, A. P., Fire Brick Co.
Louthan Mfg. Co.
Norton Co.

**Refractory Materials**
Carborundum Co.
Corhart Refractories Co.
Denver Fire Clay Co.
Electro Refractories & Alloys Corp.
Louthan Mfg. Co.
Norton Co.
Titanium Alloy & Mfg. Co.
Thomas Alabama Kaolin Co.

**Respirators**
Drakenfeld, B. F., & Co.
The Hommel, O., Co., Inc.

**Rutile**
Ceramic Color & Chemical Mfg. Co.
Drakenfeld, B. F., & Co.
Du Pont de Nemours, E. I., & Co., Inc., R. & H. Chemicals Dept.
Foote Mineral Co.
Harshaw Chemical Co.
The Hommel, O., Co., Inc.
Metal & Thermit Corp.
The Vitro Mfg. Co.

**Saggers**
Carborundum Co.
Electro Refractories & Alloys Corp.
Norton Co.
Potters Supply Co.
Taylor, Charles, Sons Co.

**Salt Cake**
American Potash & Chemical Corp.
Drakenfeld, B. F., & Co.
Harshaw Chemical Co.
The Hommel, O., Co., Inc.
Pennsylvania Salt Mfg. Co.

**Sandblast Sand**
Great Lakes Foundry Sand Co.

**Sand Grinder and Sifters**
Lancaster Iron Works, Inc.

**Saponin**
The Hommel, O., Co., Inc.

**Screening and Magnetic Separators**
National Engineering Co.

**Selenite of Sodium**
Drakenfeld, B. F., & Co.
The Hommel, O., Co., Inc.
The Vitro Mfg. Co.

**Selenium**
Ceramic Color & Chemical Mfg. Co.
Drakenfeld, B. F., & Co.
Du Pont de Nemours, E. I., & Co., Inc., R. & H. Chemicals Dept.
Harshaw Chemical Co.
The Hommel, O., Co., Inc.
The Vitro Mfg. Co.

**Setters (Tableware)**
Louthan Mfg. Co.

**Sheets (Enameling Iron)**
American Rolling Mill Co.

**Silica (Fused)**
Electro Refractories & Alloys Corp.
The Hommel, O., Co., Inc.

**Silicate of Soda**
Ceramic Color & Chemical Mfg. Co.
Denver Fire Clay Co.
Harshaw Chemical Co.
The Hommel, O., Co., Inc.

**Silicon Carbide**
Carborundum Co.
Electro Refractories & Alloys Corp.
Norton Co.

**Silicon Carbide Firesand**
Carborundum Co.

**Sillimanite Refractories**
Denver Fire Clay Co.
Electro Refractories & Alloys Corp.

**Slab Pushers—Hydraulic**
Denison Engineering Co.

**Slabs (Furnace)**
Carborundum Co.
Electro Refractories & Alloys Corp.
Ingram-Richardson Mfg. Co. of Indiana, Inc.
Norton Co.

**Soda Ash**
American Potash & Chemical Corp.
Ceramic Color & Chemical Mfg. Co.
Denver Fire Clay Co.
Du Pont de Nemours, E. I., & Co., Inc., R. & H. Chemicals Dept.
Harshaw Chemical Co.
The Hommel, O., Co., Inc.
Pennsylvania Salt Mfg. Co.
Solvay Sales Corp.
The Vitro Mfg. Co.

**Sodium Antimonate**
Ceramic Color & Chemical Mfg. Co.
Drakenfeld, B. F., & Co.
Du Pont de Nemours, E. I., & Co., Inc., R. & H. Chemicals Dept.
Harshaw Chemical Co.
The Hommel, O., Co., Inc.
Metal & Thermit Corp.
The Vitro Mfg. Co.

**Sodium Fluoride**
Ceramic Color & Chemical Mfg. Co.
Denver Fire Clay Co.
Drakenfeld, B. F., & Co.
Du Pont de Nemours, E. I., & Co., Inc., R. & H. Chemicals Dept.
Harshaw Chemical Co.
The Hommel, O., Co., Inc.
The Vitro Mfg. Co.

**Sodium Metasilicate**
Harshaw Chemical Co.

**Sodium Nitrite**
Harshaw Chemical Co.
The Hommel, O., Co., Inc.

**Sodium Silica Fluoride**
Ceramic Color & Chemical Mfg. Co.
Du Pont de Nemours, E. I., & Co., Inc., R. & H. Chemicals Dept.
Harshaw Chemical Co.
The Hommel, O., Co., Inc.

**Sodium Uranate**
Drakenfeld, B. F., & Co.
Harshaw Chemical Co.
The Hommel, O., Co., Inc.

**Soot Blowers**
Frazier-Simplex, Inc.

**Special Machines**
Frazier-Simplex, Inc.

**Spar**
Ceramic Color & Chemical Mfg. Co.
Du Pont de Nemours, E. I., & Co., Inc., R. & H. Chemicals Dept.
Eureka Flint & Spar Co.
Harshaw Chemical Co.
The Hommel, O., Co., Inc.
Maxson, Elwyn L.
Paper Makers Importing Co.
Pennsylvania Pulverizing Co.
The Vitro Mfg. Co.

**Spray Booths**
The Hommel, O., Co., Inc.

**Spraying Equipment**
The Hommel, O., Co., Inc.

**Spurs**
Louthan Mfg. Co.
Potters Supply Co.

**Stacks**
Lancaster Iron Works, Inc.

**Steel Plate Construction**
Lancaster Iron Works, Inc.

**Stilts**
The Hommel, O., Co., Inc.
Industrial Ceramic Products, Inc.
Louthan Mfg. Co.
Potters Supply Co.

**Sulfuric Acid**
Denver Fire Clay Co.
Harshaw Chemical Co.
The Hommel, O., Co., Inc.
Pennsylvania Salt Mfg. Co.

**Talc**
Ceramic Color & Chemical Mfg. Co.
Du Pont de Nemours, E. I., & Co., Inc., R. & H. Chemicals Dept.
Hammill & Gillespie, Inc.
Harshaw Chemical Co.
The Hommel, O., Co., Inc.
Paper Makers Importing Co.

**Tanks**
Frazier-Simplex, Inc.

**Tank Blocks**
Corhart Refractories Co.

**Tanks (Pickle)**
The Hommel, O., Co., Inc.

**Tanks for Raw Material Steel or Concrete**
Lancaster Iron Works, Inc.

**Tile (Floor)**
Norton Co.

**Tile (Muffle)**
Carborundum Co.
Electro Refractories & Alloys Corp.
Norton Co.

**Tile Setter Pins**
Louthan Mfg. Co.

**Tile (Refractory)**
Carborundum Co. (*Carbofrax*)
Denver Fire Clay Co.
Electro Refractories & Alloys Corp.
Green, A. P., Fire Brick Co.
Norton Co.
Thomas Alabama Kaolin Co.

**Tile (Wall)**
Denver Fire Clay Co.
Green, A. P., Fire Brick Co.
Thomas Alabama Kaolin Co.

**Tin Oxide**
Ceramic Color & Chemical Mfg. Co.
Drakenfeld, B. F., & Co.
Du Pont de Nemours, E. I., & Co., Inc., R. & H. Chemicals Dept.
The Hommel, O., Co., Inc.
Metal & Thermit Corp.
The Vitro Mfg. Co.

**Titanium**
Ceramic Color & Chemical Mfg. Co.
Drakenfeld, B. F., & Co.
Harshaw Chemical Co.
The Hommel, O., Co., Inc.
Titanium Alloy & Mfg. Co.
The Vitro Mfg. Co.

**Titanium Oxide**
Ceramic Color & Chemical Mfg. Co.
Drakenfeld, B. F., & Co.
Du Pont de Nemours, E. I., & Co., Inc., R. & H. Chemicals Dept.
Harshaw Chemical Co.
The Hommel, O., Co., Inc.
Metal & Thermit Corp.
Titanium Alloy Mfg. Co.
The Vitro Mfg. Co.

**Trisodium Phosphate**
Harshaw Chemical Co.

**Trucks**
Lancaster Iron Works, Inc.

**Tubes (Insulating)**
Carborundum Co.
Green, A. P., Fire Brick Co.
Louthan Mfg. Co.
McDanel Refractory Porcelain Co.
Norton Co.

**Tubes (Pyrometer)**
Carborundum Co.
Denver Fire Clay Co.
Electro Refractories & Alloys Corp.
McDanel Refractory Porcelain Co.
Montgomery Porcelain Products Co.
Norton Co.

**Uranium Oxide**
Drakenfeld, B. F., & Co.
Harshaw Chemical Co.
The Hommel, O., Co., Inc.

**Uranium Oxide (Yellow-Orange-Black)**
Drakenfeld, B. F., & Co.
Du Pont de Nemours, E. I., & Co., Inc., R. & H. Chemicals Dept.
The Hommel, O., Co., Inc.
The Vitro Mfg. Co.

**Water Softening Plants**
Frazier-Simplex, Inc.

**Wet Enamel**
Ceramic Color & Chemical Mfg. Co.
The Hommel, O., Co., Inc.
Ingram-Richardson Mfg. Co. of Indiana, Inc.
Porcelain Enamel and Mfg. Co.
Titanium Alloy & Mfg. Co.
The Vitro Mfg. Co.

**Whiting**
Ceramic Color & Chemical Mfg. Co.
Drakenfeld, B. F., & Co.
Du Pont de Nemours, E. I., & Co., Inc., R. & H. Chemicals Dept.
Hammill & Gillespie, Inc.
Harshaw Chemical Co.
The Hommel, O., Co., Inc.
Paper Makers Importing Co.
The Vitro Mfg. Co.

**Winding Drums**
Lancaster Iron Works, Inc.

**Zinc Oxide**
Ceramic Color & Chemical Mfg. Co.
Du Pont de Nemours, E. I., & Co., Inc., R. & H. Chemicals Dept.
Harshaw Chemical Co.
The Hommel, O., Co., Inc.
The Vitro Mfg. Co.

**Zircon**
Foote Mineral Co.
The Hommel, O., Co., Inc.

**Zirconia**
Ceramic Color & Chemical Mfg. Co.
Du Pont de Nemours, E. I., & Co., Inc., R. & H. Chemicals Dept.
Harshaw Chemical Co.
The Hommel, O., Co., Inc.
Metal & Thermit Corp.
Titanium Alloy & Mfg. Co.
The Vitro Mfg. Co.

**Zirconium Oxide**
Foote Mineral Co.
The Hommel, O., Co., Inc.
Titanium Alloy Mfg. Co.

**Zirkite (Natural $ZrO_2$)**
Foote Mineral Co.

# THOUSANDS OF PERMANENT COLOR STANDARDS IN OUR FILES

UNIFORMITY is the outstanding characteristic of du Pont Colors for Glass, Enamel, and Pottery. This uniformity is insured by an elaborate system of Permanent Standards.

A quantity of each color developed in the du Pont Laboratory is set aside in special vaults. Some of these Permanent Standards date back for more than thirty years. Every new run of coloring material is tested against the Permanent Standard, a portion of the Permanent Standard being applied and fired side by side on the same piece of ware with the new batch. No batch is allowed to go into stock unless it checks with the Permanent Standard.

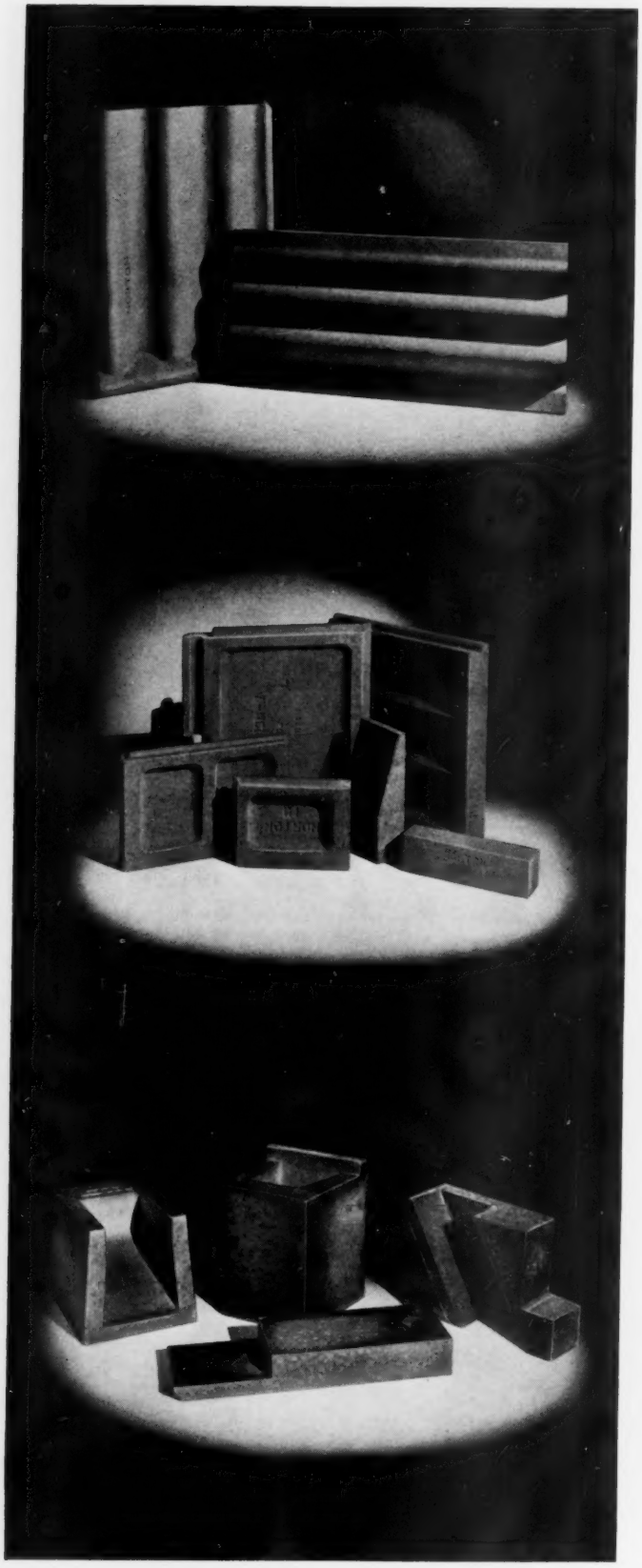
Whether you use a standard du Pont Color or a special color developed by the joint research of your technical staff and the du Pont Service Laboratory, every care is taken to provide a color which meets your requirements.

*We invite you to submit your color problems to us.*

DU PONT

CERAMIC PRODUCTS DIVISION

**E. I. DU PONT DE NEMOURS & COMPANY**
INCORPORATED
**The R. & H. Chemicals Department**
Wilmington, Delaware
*District Sales Offices:* Baltimore, Boston, Charlotte, Chicago, Cleveland, Kansas City, Newark, New York, Philadelphia, Pittsburgh, San Francisco



# KILN LININGS

In both tunnel and periodic kilns Alundum Corrugated Plates, Tiles, and Brick have demonstrated conclusively their ability to stand up for years under constant high temperatures. In numerous plants they are cutting lining costs because of their chemical stability, high refractoriness, and great strength, which combine to give long life. Their high heat conductivity saves fuel.

# ENAMELING MUFFLES

Long life and trouble-free service result from the high refractoriness and chemical stability of Alundum Muffles and Brick in enameling furnaces. From their high strength, which allows plates of thin cross section and their high heat conductivity, comes their ability to cut fuel costs by passing heat quickly from source to work.

**Engineering Service**

Norton engineers, experienced in solving problems for the ceramic industry, are available to help you handle heat more effectively. They are ready to aid in the adaptation of standard Norton refractory products to your needs or to cooperate in the design of special shapes if necessary, such as those shown in the lower illustration. Take advantage of this Norton Service.

**NORTON COMPANY, Worcester, Mass.**

NORTON REFRACTORIES

R-680A

H. C. SPINKS CLAY COMPANY

Miners and Shippers of

BALL, SAGGER AND WAD CLAY

NEWPORT, KY.

Baltimore, Md.
April 3, 1941

Mr. Pete Potter
Comfortable Sanitary Pottery Mfg. Co.
Pottsville, U. S. A.

Dear Pete:

Dick Carothers is so busy selling clay here at The American Ceramic Society Meeting that he hasn't had time to write. He asks me to tell you that your orders for CHAMPION and CHALLENGER are on the way and that regardless of all the new orders he is getting here, your orders will always be shipped promptly.

Sincerely,
Marie

(Writing for) Dick Carothers

General Manager
H. C. SPINKS CLAY COMPANY

P. S. Dick says, "If you come to Baltimore, bring your own horses." M.

Setting up test plates in abrasion testing machine in Metal & Thermit laboratory.

# *the white that was green . . .*

A refrigerator manufacturer was at his wits' end. His porcelain enamel, instead of a pure white, was turning out a lovely light pastel green! A fine color for the living room wall — but for refrigerators!

A hurry call to our ceramic laboratory brought a quick solution. Sodium Antimonate was substituted for Oxide of Antimony in the formula. Result? A rich, dense, enduring, white enamel finish.

Other peoples' glaze and enamel production troubles are the particular forte of our ceramic laboratory. The service is rendered without charge to users of opacifiers.

Inquiries are invited. No obligation, of course.

For a uniform, dense, pure glaze—free from specks or discolorations, specify M & T Tin Oxide as an opacifier.

For porcelain enamels M & T Sodium Antimonate assures high opacity, tensile strength and resistance to alkalis and abrasion.

**M&T**

**TIN OXIDE**

**SODIUM ANTIMONATE**

★

## METAL & THERMIT CORPORATION

120 BROADWAY NEW YORK, N. Y.